THE

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ELECTRICAL REVIEW.

Vol. LXV.] CONTENTS: August 6, 1909. [No. 1,654.

	Page
The Brussels Exhibition	201
Jet Condensers	202
Is there an Implied Warranty on the Sale of a Patent?	203
A Point in the Law of Trade Marks	203
A Novel Oven	203
The Undertaking of the Adelaide Electric Supply Co., South Australia (*illus.*)	204
The Man of Resource	206
Repayment of Capital: Municipal Electricity Works in London	207
A Slipway Haulage Gear for France (*illus.*)	208
An Electrical Conditioning Oven (*illus.*)	209
Electric Chafing Dishes (*illus.*)	210
An Electrically-Operated Turbine Fire Pump (*illus.*)	210
An Aerial Ropeway Installation (*illus.*)	211
Legal	212
New Electrical Devices, Fittings and Plant (*illus.*)	214
Business Notes	215
Notes	221
City Notes	223
Market Quotations	228
Stocks and Shares	228
Share List of Electrical Companies	229
Metal Market.—Fluctuations in July	231
Detroit River Tunnel Electric Locomotive	231
Reviews	232
Determining the Amount of Injection Water Required to Condense Exhaust Steam	235
Proceedings of Institutions:—	
The Electrical Operation of Textile Factories	236
Some Tests and Uses of Condensers (*illus.*)	237
Institution of Electrical Engineers	238
Foreign and Colonial Tariffs on Electrical Goods	239
New Patents Applied For, 1909	240
Published Specifications	240
Contractors' Column ... ... Advertisement pages 56 and 58	

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THE

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(J. A. BERLY'S).

1909 EDITION

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THE BRUSSELS EXHIBITION.

As a place of entertainment, owing to the wonderfully favourable weather, the Franco-British Exhibition last year was phenomenally successful; as an industrial concern quite so much could not be said of it; and the arts and crafts which particularly interest our readers were not satisfactorily represented at all. Some important steps, however, have been taken to remove the stigma which has hitherto been attached to British representations at great international shows; and, although in some respects the Government have not gone as far as we suggested, in the series of articles which ended in March last year, in other ways they have gone further and done more than was expected of them. No advantage was taken of the presence of the Comité Français and of the host of representatives from overseas to lay the foundations of a similar body for the Empire in general; nor, as far as we know, during the Press Conference, was attention drawn to the good work being done by the new Exhibitions Branch of the Board of Trade, work which should be undertaken by all our Colonies and Dependencies. In fact, in our opinion, the new Department has been doing good more or less by stealth (as, indeed, is very much the habit of our officials), and it has not practised what it preaches—viz., the efficient use of advertisement. Of course, as it is a Government affair, there is no precedent for the carrying out of an extensive Press campaign from a big publicity bureau; but on the other hand, the whole business is a new departure, and, therefore, precedents are inapplicable.

So much for what has not been done; we turn now to the more agreeable task of recording that Mr. U. F. Wintour, the Commissioner-General, and his zealous assistants are doing more for exhibitors at Brussels from the United Kingdom than has been done before by any other body; indeed, even more than the Comité Français does for its members. Pity it is that such excellent arrangements as have been made could not have been extended throughout the Empire, and thus by co-operation and co-ordination have given the world in general a practical example of the resources of the British Empire. This may come in time, and the idea might be mooted during some function of the present Defence Conference. Surely what may be called industrial defence is as important as any other kind of protection from possible evils, and no better opportunity for bringing the matter forward is likely to occur for some years to come. The present Exhibition Branch, it is true, is in its infancy, and it must learn to walk warily and steadily and gain experience in the comparatively narrow national path it has chosen before venturing on the broad imperial highway which, in course of time, it will be able to negotiate successfully, and

which will lead to the collection of the Empire's exhibits in one stately building made up of various courts, harmonious, and yet characteristic of the various nationalities and dominions.

Failing organised private enterprise, the Exhibition Branch of the Board of Trade, whose offices are in Queen Anne's Chambers, Westminster, has boldly stepped into the breach, and is now doing more than is done for the exhibitors of any other nationality. A prominent position has been secured, such that the main stream of visitors will have to pass through the British Section in order to reach those of other nations; the space allotted is as great as that of any other country, and those who take advantage of this unique opportunity will be able, with the help of the Department, to know beforehand to a penny what their venture will cost them. The only charge will be for space and that is very moderate indeed, considering what this charge will cover, viz., show-cases, general decorations, the handling of the goods between the entrances and the space allotted, and back again, catalogue entries in French and English, storage of packing cases, unskilled labour, as far as possible, free installation, and last, but not least, the passing through the Customs at the gate of the Exhibition, there being no octroi. In the case of machinery there will, of course, be extra charges, but all of them are on a similarly moderate scale; crane power will be provided gratuitously, and the laying of the foundations by Belgian contractors will be under the superintendence of the Royal Commission's engineer; inventions, industrial trade marks and designs will be protected; lastly, a suite of reading, writing and business rooms will be provided for exhibitors' agents, with a reference library and a staff of high-class interpreters. Reduced charges by land and sea will be made for all returned exhibits. These and all other particulars are willingly given at the offices, where applicants will find that their inquiries, whether personal or in writing, are treated in a prompt, businesslike and unusually courteous manner. A sum of £60,000 has up to now been allotted by Government for expenses in connection with International Exhibitions at Brussels, Rome and Turin. A reference to our previous articles will show that in this matter, so far, there is no new departure, for the average Government contribution has been £27,800 in 23 Exhibitions; as, however, the greater part of the funds were often, in the past, squandered on lovely, but insignificant looking, and enormously costly Royal Pavilions, and as there is no intention of repeating this folly, the money will go much further than it has ever done before.

The number of applications for space to show both individual and collective exhibits is so satisfactory that the success of the rather sporting venture is secured. Collective exhibits are being organised at Bradford, Nottingham, Huddersfield, Galashiels, Macclesfield, Bury and Wycombe, and there is a good prospect of this being done elsewhere; one cotton firm alone has appropriated 5,200 sq. ft. Sir Boverton Redwood is arranging a collective exhibit of the fine chemical trades, and strong individual exhibitors in the electrical, iron, steel and engineering trades, are coming in, following the example of Messrs. Armstrong, Whitworth and Co. Shipbuilding and land transport generally, especially the motor trades, will be well represented, as well as the Northampton and Walsall specialities, manufacturing grocers, and the makers of sanitary fittings, &c. There will be a "Road Conference" during the Brussels Exhibition, with which, by the way, it is to be hoped the Anglo-Japanese Exhibition next year will not clash, to their mutual disadvantage.

Jet Condensers.

Our contemporary, the *Engineer*, recently put in a plea for the jet condenser, which it is averred has been ousted by the surface condenser, a type, new for land purposes, that has become fashionable of late years, and having become the fashion, has been put in at places both fit and unfit. The fashion of the surface condenser, no doubt, grew up on a good foundation, for it arose out of the boiler scale difficulty. The soft water from a surface condenser carries no salts of lime, and condensed steam is an ideal boiler feed. But condensed steam plus oil is anything but ideal, and the use of the surface condenser has brought in its train oil separators which are by no means devoid of trouble. And probably some of our readers may be acquainted with places where, with a perfectly soft feed-water, surface condensation has been adopted at a quite unnecessary cost. With soft feed-water, a feed-water surface heater is a justifiable preface to a jet condenser, but it is obviously wasteful to employ general surface condensation. Of what value, for example, would surface condensation be with feed water of the quality of the public water supply of Manchester, Leeds, Glasgow, and some other of the northern towns? And after all, is not a jet condenser a surface condenser—for the steam condenses upon the surface of the water injected? Since a water jet falls in drops if it is more or less broken up, the condensing surface is the superficial area of the drop. Water being a poor conductor of heat, it follows that where a drop of water is large, it will consist of a cold central core surrounded by a hot thin shell. There is probably no definite information that will tell us how thick this hot envelope will be in the case of water falling, say, 8 ft., in company with exhaust steam. It is, however, certain, if the kinetic theory of steam be accepted as a working hypothesis, that the steam, with its velocity of molecules of 1,800 ft. per second, must encounter some water in a condenser of, say, 3 ft. diameter, since a molecule of steam would travel 420 diameters of the condenser, while a drop of water was falling 8 ft.

Our contemporary points out that the larger air pump will not be more costly than the small air pump plus the circulating pump of the surface condenser. There is no comparison between the cost of a jet and a surface condenser, and, if some air does get in with the jet, are there no leakage troubles with the tube ends of a surface apparatus?

To return to the question of division of the jet, if it be assumed that a drop of water of $\frac{1}{16}$ in. diameter will be heated throughout by, say, 50° F. in its fall through the steam, then a drop of $\frac{1}{2}$ in. diameter will only acquire an average temperature of approximately half of this, for its area being fourfold, it will absorb four times the heat to add to an eightfold mass, and the water will flow away at 75° F. only. In order, therefore, that jet condensing may be fairly efficient, the water supply should be well comminuted, and it would appear rational to admit steam near the base of the condenser to meet water falling from spray nozzles in the head.

Fault is found with the admission of the jet so that it is directed against the side of the condenser. No very serious objection need be raised to this. It was quite a common practice in Lancashire to carry in the jet near the top of a vertical condenser and let it splash itself simply against the opposite side; and with hot-well temperatures of 100° F. very high vacua were often obtained, which seems to show that our drop theory above put forward may be a needless sort of refinement. Also, the old practice brought in the steam at the head of the condenser, athwart the entering jet of water, it is true, but with no provision for spraying except the eddying set up in traversing the pipe and

the injection valve. Indeed, while at one time the injection pipe had an internal perforated length extended inside the condenser, as may be seen in old illustrations, these were eventually omitted, being found of no value.

It may well be argued that surface condensers are often a costly fad that involve as much expense in oil treatment as would put down a feed softening plant. There are some feed waters that cannot readily be softened; if they contain much lime sulphate there will be a concentration of soda sulphate in time in the boilers. But a plain carbonate water can be softened, and an initially soft water will usually be improved for boiler purposes if filtered through limestone chips so as to kill its peat acids and help to form an eggshell scale on the boilers.

It would appear to-day that some of the men responsible for power-station design do not give sufficient thought to the condensers. Many of them, trained up during the surface-condenser period, seem to regard the jet condenser as a cheap and inferior appliance; others, perhaps, think it is obsolete because of some inherent fault. As a fact, the surface condenser was originated for marine purposes, to get over the inherent disability of sea water—to wit, its salt; it was regarded, in fact, as a necessary nuisance, and it is only justified to-day where there is sufficient of the same evil that brought it into being—namely, some impurity in the water that cannot be got rid of.

Is there an Implied Warranty on the Sale of a Patent?

At a time when an Act of Parliament renders the working of patents more or less compulsory in England, there is much to induce the patentee either to sell his monopoly out and out, or else license its user by other persons. He may not be in a position, financial or otherwise, to do the work himself; a little ready cash on an assignment, or the grant of a licence may be much more acceptable than the flotation of a company or the erection of a factory. But what are the obligations of a man who grants a licence or assigns his patent? Does he warrant the validity of his invention? Does he warrant that it infringes the patent of no other person? Finally, does he impliedly undertake to do nothing in respect of the invention which will jeopardise its validity? The question whether an assignment involves a warranty of the validity of the patent was decided in Smith *v.* Neale, 1857, 26 L.J.C.P. 143. There, to a declaration alleging a contract for the assignment by the plaintiff of the letters patent in trust for an institution, and upon the terms contained in the proposal of the defendant, the defendant pleaded that there had been no assignment, on the ground that the patent was invalid. It was held that either the contract involved no warranty by the plaintiff and that the invention was new, or that the manufacture was within the statute of James, and therefore that the plea put in issue no more than the mere grant of the letters patent which the plaintiff contracted to assign.

It would seem also that on the sale of an article which is provisionally protected, the purchaser cannot complain if the various allegations made by the patentee as to the great merits of his invention are not realised. Thus in Smith *v.* Buckingham, which was heard in 1870, by an agreement, after reciting that the plaintiff had lately invented an improved composition or material to be employed in waterproofing or rendering woven fabrics impervious to moisture, for which he had duly obtained provisional protection, and had obtained a certificate of protection, it was agreed between him and the defendant, for the considerations therein mentioned, and in consideration of a further sum of £350, to be paid on the completion of the necessary specification and grant of the letters patent, to transfer and make over to the defendant all his interest in the invention or improvement thereof, and all benefit to be derived from the provisional protection, or from any letters patent to be thereafter granted for the invention. In an action on this agreement to recover the £350, the defendant pleaded that the plaintiff had not invented an improved composition or material to be employed in water-proofing or rendering woven fabrics impervious to moisture: Held, that the plea was bad, as there was no implied warranty that the patented article was good for what was claimed for it.

On the assignment of a patent without a warranty, the assignee may not, in an action upon the contract of assignment, set up the invalidity of the patent as a defence. An express covenant for the validity of the patent will of course remove the estoppel, and the assignee may rely on this in answer to an action for the purchase money (Nadel *v.* Martin, 1903, 20 P.O.R. 735).

In Smith *v.* Scott, 1859, 6 C.B.N.S. 771, it was decided that where a licence to use certain patent machines is granted by indenture, in which it is recited that the grantor has invented the machines, and has obtained letters patent for the sole use of the invention, and inrolled the specification, parties (and privies) are estopped from pleading either that the invention is not a new invention, or that the grantor was not the first inventor, or that no specification was enrolled.

These statements of the law may serve to draw the attention of those who are acquiring patents, to the desirability of securing some kind of written warranty from the patentee. If the invention is really valuable and good subject matter for a patent, the patentee will not be shy about putting the matter into writing. Now that the patent officials take some steps to inquire into the validity of the inventions which are made the subject of sealed patents, there is less difficulty than formerly in deciding whether there is good subject matter.

A Point in the Law of Trade Marks.

The manufacturer whose commodity has become identified in some degree with a particular place is naturally desirous of connecting the article with the place by means of a name which can be registered as a trade mark, but the law does not allow this. By the Trade Marks Act, 1905, a registered trade mark may be either "a word or words having no direct reference to the character or quality of the goods, and not being according to its ordinary significance a geographical name or a surname," or "any other distinctive mark." The word distinctive mark, however, means "adapted to distinguish the goods of the proprietor of the trade mark from those of other persons." In the case in question, the proprietors of a medicinal preparation sought registration of "California Syrup of Figs." The evidence showed that it had been introduced into England some 12 or 13 years ago, and that the preparation had been continuously sold here under that name. The name was on the bottles, and did, in fact, distinguish the manufacture of the applicant's from other preparations of a similar manufacture in this country. It was held upon these facts that the trade mark sought to be registered was not one which was adapted to distinguish the goods of the applicant's from those of other persons within the meaning of Sec. 9, and, therefore, that the application must be refused.

A Novel Oven.

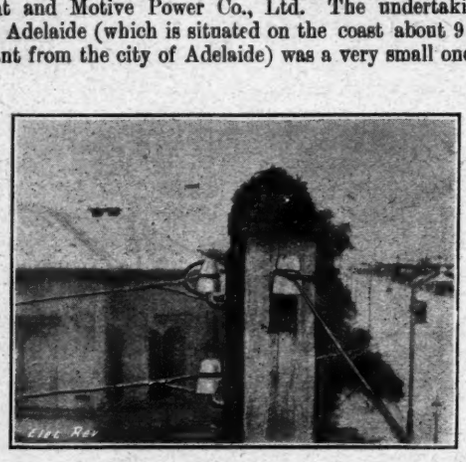
An interesting application of electricity to the needs of the textile business—one of the many such developments of the past year or two—is the electrical conditioning oven, designed by Messrs. Ellis and Allsopp, of the Bradford Municipal Electricity Department, for use in connection with the local woollen industry, and described in a later page.

Those who are acquainted with Bradford's municipal enterprise will be aware of the important part played in the local textile industry by that Corporation's conditioning house—or, to use a more homely title, testing station; and there is little doubt that any improvement in the apparatus for use in this direction will be generally appreciated by the textile community, not to mention the many others whose business it is to popularise the use of electricity for all and sundry purposes.

THE UNDERTAKING OF THE ADELAIDE ELECTRIC SUPPLY CO., SOUTH AUSTRALIA.

By J. H. DAVIES.

In 1899 the Electric Lighting and Traction Co., already carrying on business in Victoria, in which State it owned electric supply undertakings at Melbourne and Geelong, acquired a small undertaking, situated at Port Adelaide, South Australia, and a private Electric Supply Act, authorising electric supply within the city of Adelaide, its suburbs and elsewhere, from the South Australian Electric Light and Motive Power Co., Ltd. The undertaking at Port Adelaide (which is situated on the coast about 9 miles distant from the city of Adelaide) was a very small one, and



Cremated Ants' Nest on Distribution Pole, Adelaide.

as the load has since been transferred to the main supply system in Adelaide, there is no need to refer to it at length; the Adelaide undertaking was built up by the Electric Lighting and Traction Co., and within the last two years by its successor—the Adelaide Electric Supply Co., Ltd.—which has acquired the whole of the former company's interests in South Australia.

Besides the private Act taken over from the original holders, only a small uncompleted portion of the buildings for a central station, which had been commenced, was taken over as well. These were on a centrally-situated site in Grenfell Street East—that is, within the city area proper.

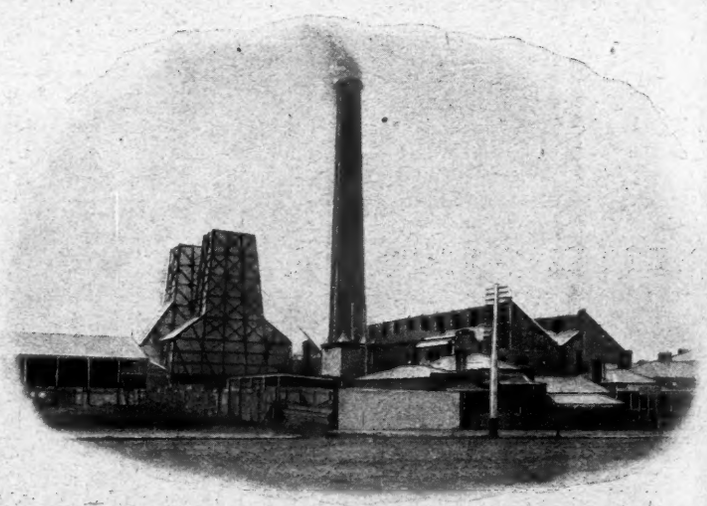
In consequence of the lay out of the city, special consideration had to be given to the question of distribution. Adelaide, with a population of 150,000 inhabitants, like most Australian cities, covers with its suburbs an enormous area, and in this particular case the area is again inordinately increased by the city portion proper being surrounded by a belt of park land, half a mile wide, thus throwing the suburbs still further out from the business centre, near which the supply station is situated. It was ultimately decided, therefore, to distribute within the city, on the three-wire, continuous-current system at a pressure of 400 volts between the outers, and to the suburban portions by means of alternating, single-phase current. For the first three or four years, however, the company's energies were taken up in meeting the demands for a supply in the continuous-current area, and as this area would for many years be the principal one as regards magnitude of requirements, it was decided to lay out the power house as a continuous-current station only, leaving the alternating-current arrangements to a later date. A small pioneer plant was, therefore, put down to test the demand, and the requirements have increased at such a rapid rate, that the present installation consists of two 200-kw. Willans-Peebles steam generators, one 850-kw. Brush-Parsons turbo-generator, and two Belliss-Brush 750-kw. steam generators. The Brush turbine set is fitted with only one generator of 850 kw., the machine being provided with polar windings and interpoles.

Two 100-kw. steam balancers and one 30-kw. motor balancer are also installed.

South Australia being generally a very dry and somewhat waterless country, the condensing arrangements required very careful consideration.

The plan adopted allows of all the Willans-Peebles generating sets exhausting into a common exhaust pipe, connected to two barometric condensers of the siphon type, which do not require the use of an air pump. The turbo-generator exhausts into a barometric condenser of the counter flow type, in which the air is drawn off from the top by means of a motor-driven Mirrlees-Watson dry air pump. The two 750-kw. Belliss sets exhaust into one common condenser of the surface type, below floor level. The circulating water is cooled by means of natural draught cooling towers, and as the temperature in Adelaide during the summer often rises to 110° and over, it will be seen that not only is a large capacity in cooling towers necessary, but that the quantities of circulating water to be dealt with are also large. The barometric condensers discharge into a pit 20 ft. below the general floor level of the station, and the combined hotwell and circulating water is raised by means of totally immersed centrifugal pumps (operated by vertical spindle motors situated at floor level) to the top of the cooling towers; and as the sumps of the cooling towers are at a higher level than the engine room floor level, the use of a pump for returning the cooled water to the tops of the barometric condensers is unnecessary, as the condensers draw their own water.

The boiler house is laid out on the principle of reserving the centre portion for the economisers and by-pass portion of the flue, whilst a set of boilers is placed at each side. The boilers originally installed consist of four of the Babcock and Wilcox type, hand fired, but in consequence of the extremely rapid increase in load, it has been found necessary to lay out the remaining space on the other side of the economisers for as large boilers as could be conveniently got in, and therefore two Babcock boilers of 3,580 sq. ft. heating surface each have been installed, and two further boilers are contemplated for erection during the coming year. These larger boilers are fitted with automatic chain-grate stokers, and an ash tunnel communicating with an elevator and bin,



The Adelaide Electric Supply Co.'s Power Station, South Australia.

runs underneath them. Coal bunkers, delivering the coal through side chutes into the boiler house, are built up parallel with the boiler house wall, and fuel is elevated into them and ash removed by a continuous, motor-driven, push plate conveyor.

The feed water is measured by means of one of Leinert's weighing meters of a maximum capacity of 9,000 gallons

per hour. This meter operates on the principle of carefully poised buckets which tilt and automatically discharge their contents through siphons when a certain weight of water has been poured into the bucket. Two buckets, side by side, are fitted, and an automatic throw-over arrangement is provided, which deflects the stream of water from one bucket to the other as they alternately fill and discharge.

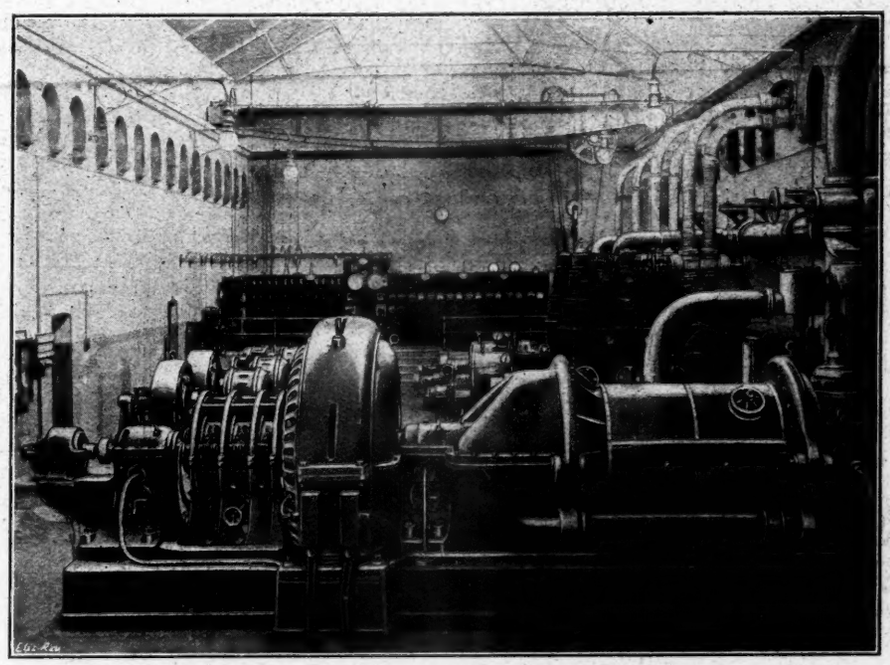
The continuous-current switchboard takes up the full width of the engine room with a H.T. alternating board at right angles to it, but in consequence of the rapidly increasing load, it is already evident that more space will be required for the switching arrangements, and this will probably be provided within the next year.

As regards the alternating-current portion of the undertaking, this work has already been commenced, and is being pioneered during its early stages by the use of motor-generators, operated from the existing continuous-current plant. The motor-generators installed consist of one set of 50 KW., two sets of 100 KW. each, and a third set of 200 KW. is in process of erection.

As stated above, the business and city area proper is supplied by means of a three-wire continuous-current system of mains with 400 volts across the outers. These are laid throughout the greater part of the city underground, on the solid system, lead sheathed, paper-insulated cable being usually employed. In the outskirts of the city area hard-drawn copper, overhead mains, supported on jarrah or ironbark poles, are used.

In the suburban areas, distribution is effected by means of the single-phase alternating-current system, in which H.T. concentric feeders at 2,000 volts are run underground, on the solid system, to a number of transformer sub-stations placed beneath the pavements. Secondary distribution on the three-wire system with 400 volts between the "outers" is carried out entirely above ground by means of bare, hard drawn, copper cables, supported on poles. The proper material for poles has been the subject of much consideration, for Adelaide is much infested by the white ant. Ant-proof qualities are popularly attributed to jarrah, but the company is continually coming across cases in which the white ant does damage. It will eat away the jarrah troughing of the mains laid on the solid system, down as far as the pitch; in fact, in another Australian city it has even been accused of consuming the pitch and a portion of the lead, thus bringing about a "short." Poles, apparently sound, are upon examination found to be supported only by the skin of paint on the outside, and short circuits have taken place at the tops of 30 ft. poles, supporting special terminal devices, in consequence of the ants having bored up through the centre of the pole and built their nests under the metal cap covering the terminals, until the whole colony was suddenly cremated. The company's experience is that ironbark, obtained from New South Wales, is considerably better in its ant resisting qualities than even the well known jarrah.

It was decided some two years ago to shut down the separate station at Port Adelaide and to change the supply over from continuous current to alternating current and connect it with the main power house in Adelaide proper, by means of a transmission line, nine miles long; this transmission line is underground at both ends, where it passes through busy streets, but for the greater part of the distance it runs overhead along a country road. The overhead portion, consisting of bare hard-drawn copper, is supported on ironbark poles by means of special extra high tension insulators, glazed a dark colour so as to afford less temptation to owners of catapults and rifles, and is so arranged that the "outer" is split into two cables of half the sectional area of the "inner" and placed below the latter, the "inner" taking the topmost position on the pole. At intervals along each span, short lengths of wire connect the two halves of the "outer," forming a kind of cradle into which the live "inner" could fall in case of breakage, thus short-circuiting the line and blowing the fuses at the supply end. At the supply station the pressure is stepped up from the 2,000 volts pressure for the suburbs immediately surrounding Adelaide, to 4,000 volts, and this is distributed at the Port Adelaide end on the three-wire overhead system with 400 volts between the "outers," thus corresponding exactly with the supply given on other portions of the system. Another similar line about 8 miles long is shortly to be constructed to supply the small coastal residential town of Glenelg.



INTERIOR OF THE ADELAIDE ELECTRIC SUPPLY CO.'S GENERATING STATION.

The following statistics are interesting:—

The population of Adelaide and suburbs, together with Port Adelaide and Glenelg, is about 150,000.

The area of the districts actually covered by the private Act is of very great extent, namely, about 67 sq. miles.

The connections total the equivalent of about 129,334 30-watt lamps, and about 1,832 H.P. in motors are included.

The output during the past 12 months was 1,575,019 units, and it is very rapidly increasing from year to year; 39·6 miles of H. and L.T. cable have been laid underground, and the electric supply is available along 82 miles of street.

The company has just lately arranged with the Tramways Trust for the supply of about 1½ million units per annum

until such time as the trust shall have completed its own power house; for this the pressure will be boosted by a specially constructed and compounded motor-generator of 200 KW. capacity, in series with the main current. The Adelaide tramways system is at the present time being changed over from horse to electric traction, and is a very large undertaking, some 70 miles of track being under conversion. This is being carried out by a Municipal Tramways Trust, whose chief engineer is Mr. W. G. Goodman.

The head office of the Adelaide Electric Supply Co. is at Finsbury Pavement House, London, but there is a local advisory board in South Australia.

The writer is indebted to the company's manager, Mr. F. W. Clements (who, by the way, is also engineer and manager of the Melbourne Electric Supply Co., Ltd.) and its engineer, Mr. Wheadon, for the kindly assistance which enabled him to prepare this article.

THE MAN OF RESOURCE.

By C. A. SMITH, B.Sc., A.M.I.E.E.

The Public, the Inventor and the Apprentice.

The Electrical Review told us, in a striking leading article,* that "it is, indeed, wholly erroneous to imagine that the majority of our adult population are in search of knowledge of any kind. The person who attempts to teach them by pen or by word of mouth is guilty of presumptuous sin." But that statement is only partially correct. You cannot balance it with the proven fact that the self-education and "get on or get out" books have phenomenal sales. You cannot neglect the strength of the public appetite for "Science Bits" and the paragraphs about radium and "The Electric Gun." The public are willing to *search* (in a desultory manner, it is true) for knowledge of a kind, but it must be served up to tickle the public's palate.

What the British public seem hopelessly to lack is the power of *concentration*.

The same evil is apparent in the evening student at technical schools. It is staying power that is wanted. Only too frequently during the race the student gets "winded" and drops out. Contrast the attendance at evening classes at the beginning and the end of the session. In some cases the authorities at the school are to blame. They are quite content for a student who has been at work all day to take up four or five evenings a week at the technical school. Frequently no home work is done in one subject; interest flags; the result is inevitable. The student gets his tuition practically free, and he does not value it much above the coin which gains him entrance to the class.

The technical schools and colleges are in danger of attempting to teach too many subjects. It is not at all unusual for an evening student to be taking, during a winter session, instruction of the Board of Education "stage two" order, in steam, applied mechanics and machine drawing. Frequently a fourth subject, such as mathematics or electricity and magnetism, is taken; and if the first two and the last subject mentioned above are to be understood, then laboratory instruction is essential. There are, of course, students of great ability who can carry the load, but we must lay out our programme for the average student, and unless a lecturer is well aware of the great ability of the student, he should strongly advise him to *concentrate* upon not more than two subjects. Unfortunately, the Board of Education grants are given on the attendances; there is, therefore, every encouragement given to the authorities to overload the student and to sow seed for spasmodic efforts. A glance at a time-table before me as I write reminds me of the story of the Quaker lady and Southey. After the poet had, with no little satisfaction, explained how he studied Spanish at breakfast, Portuguese when shaving, wrote poetry from 3 to 5—how, in a word, every minute was occupied in reading, writing, eating, exercise or sleeping—she replied, "and friend, when dost thee *think*?"

* May 15th, 1908, "The Attitude of the Public towards Science."

The three greatest factors in this life are will, imagination and concentration. An acorn cannot grow unless it has a fit soil, and the student will never really learn until he has been taught to think for himself. The average products of the evening classes of this decade are apt to resemble human gramophones. For a time they possess an encyclopædic knowledge of certain facts connected with science—and then they gradually forget most of it. It seems a pity to set such store on memory, when it is hard common-sense that is so often required.

John Milton, two and a half centuries ago, told us that "though a man have all the tongues that Babel cleft the world into, yet if he has not studied the solid things in them, as well as the words and lexicons, he were nothing so much to be esteemed a learned man, as any yeoman or tradesman competently wise in his mother dialect only." It is the complete education which is needed.

In London there is a great tendency for a student to acquire nomadic habits. Many wander in and out of technical colleges, like stray ions. There is no disguising the fact that there is a tendency to overrate the importance of numbers at a college. There is also, unfortunately, considerable overlapping. No one objects when the boy leaves the Board School, and passes on to a more advanced centre of learning; but what should we think if, at every Board School, they offered to coach for the London final B.A. and B.Sc.? Yet many technical schools are making efforts to send men in for the "final." Why should they not *concentrate* on trade school work? Co-operation is needed. The polytechnics and the colleges should concentrate upon the type of instruction most suitable to the *majority* of their students. The lecturer suffers from this tendency to cover such a large range of subjects. Most lecturers involuntarily suffer from the same complaint as Southey; their time table gives them but little chance to *think*. Too often a steam hammer is used to crack a nut. Men capable of doing original research teach very elementary subjects, as well as those which are considered advanced. The teacher cannot concentrate. Perhaps the State, or the business man who we hope will endow technical colleges, does not fully appreciate the value of research. The Electrical Review for May 15th, 1908, says that it is the public who do not appreciate these things. But are we sure that the public cannot be led to take a deeper interest in such matters?

There is no publication in this country which fills the same niche as does *The Scientific American* across the Atlantic. But the circulation of semi-technical and workshop journals among the mechanics is an encouraging sign. It is clearly much better for the artisan to be interested in details connected with his work than in *Scrappy Bits*.

There seems, however, no paper suitable to the man who knows not science but who wants to read about things scientific. It would need a great deal of energy to found such a publication, and success is not certain. But it is curious that no attempt has been made in such a direction.

Practical Research.

Prof. Churten Collins, an authority on literature, says that science is attracting the greatest intellects into its ranks. Every side of our life, from the cradle to the grave, is touched by the works of the inventor. The public are aware of this fact. Is it then hopeless to attempt to influence public opinion concerning the value to this country of invention and research?

There is a very popular idea that research work at college must necessarily mean that the member of the staff who conducts it should be divorced from his students. It must have been with this thought in his mind that Mr. James Swinburne, when addressing the students of the Institution of Electrical Engineers, said: "There is no more baneful influence on the technical advancement of this country than the Royal Society ideal in science." But is it necessary that research should embrace only subjects that are caviare to the million, and that may not become of any practical value till long after the professor's death? May not research include things that we should like to know now, and that would assist in the commercial struggle with other nations? Surely this kind of work is just what would be excellent teaching for the student. He would

be getting a good inkling of the actual conditions of the work he would have to do later. And there are numerous practical problems coming well within the region of research that would be very instructive indeed in working out, and that would be of immense value to the nation when solved.

The New Man.

The Elementary Education Act of 1872 has brought into existence a new type of mind. There has been so much talk about the "new woman," that we are apt to overlook the coming of the "new man." The old apprenticeship system is gone; the boy in the works frequently does not get the opportunity to learn a trade thoroughly. Sometimes he drifts into a small repair shop, and gets to the stage of the "Let's-'ave-a-look-at-it" mechanic. Attention has been drawn in these columns to the excellent trade schools of Mr. Stanley at Norwood. It might be possible for some of the technical schools to formulate day classes for lads on the same general plan. It is our duty to do something to improve the youthful "new man." We must try to make him take an interest in things scientific. He possesses quite a different type of mind to that of his predecessor of 30 years ago, who stolidly pushed the plough and drove the cart horse. When given the opportunity he usually takes kindly to things mechanical. Probably, just at present his great ambition is to become a chauffeur. There is a penny motoring paper with a weekly circulation of 50,000 copies. Observe what a number of these are purchased by quite poor lads.

Public Opinion.

Perhaps it is true that the public are at fault. For some hundreds of nights the public attended one of the London theatres in great numbers, to see what to them was a comedy. To the deep thinker, laugh though he might at the epigram, there must have been a feeling of tragedy. It is the Barrie play, "The Admirable Crichton," that is referred to. The hero is a born mechanic. Under normal conditions he is represented in the first act as a butler in Mayfair. Suddenly, owing to the wreck of a yacht, the butler, the earl, the earl's nephew and three society girls all "return to nature." The butler is the man of resource. He saves the party from starvation, and becomes king of the island. But when the party are rescued by a warship, then they return to society as built up by public opinion.

There is only one moral to be drawn from the play. It is that the public class the engineer as the man of resource in a poor category. Politicians and lawyers are in the habit of stimulating the public interest in their doings, and quite naturally the public regards them as a class of man with a very superior intellect. And this leads us to wonder whether it is worth while trying to interest the public in things scientific as well as things political. Is it, or is it not, waste of time and energy for a man of commanding genius to lecture to the public upon a scientific subject? These thoughts flashed through my mind four years ago as I listened in the Birmingham Town Hall to Sir Oliver Lodge propounding, in his wonderfully lucid fashion, to 3,000 working men, the details of our knowledge concerning radium. In the afternoon he had given the same lecture to a fashionable audience, and in both cases his listeners awaited eagerly every word. Was he doing a great work, or should he have been communing with himself in his own laboratory? Surely he was helping the ideal of a Civic University when giving those lectures. When Prof. Silvanus Thompson gave his Kelvin lecture, one felt that a great opportunity had been missed. Surely the public should have gone in their thousands. Such an oration was of as much national importance as a great eulogy of some politician. One cannot despise the power of the daily newspapers. If public opinion is to be changed, it can only be done by the weapons of the politician. The first Kelvin lecture was worthy of more than one column in the newspapers. But we must have imagination sufficient to convince the proprietors of these great organs that the public will read and gradually become interested in such matters.

It is not altogether impossible to influence public opinion. When they can be convinced of the need, taxpayers will cheerfully agree to the spending of millions upon education. The work of the British Association and the British Science Guild deserves every encouragement. The new Universities are much more in touch with the million than many of us suppose. They are also receiving the co-operation of the local works managers. They would, of course, welcome increased assistance.

There are, therefore, two directions in which public opinion must be influenced. The public must be made to grasp the need for dealing with the youth who at present goes to swell the army of the unskilled. There must be something in the place of the old apprenticeship system; and the State must be more generous with rewards for men capable of invention. A century ago our countrymen allowed James Watt to pass away without any thought of honouring him until he was dead. We have not that lasting shame with regard to Lord Kelvin. But we are content to see the national honours showered almost exclusively upon the politicians and the courtiers. If we made efforts to convince the public that men, upon whose work great industries have been built, are worthy of their country's gratitude, then public opinion would be strong enough to insist that they should have their due.

REPAYMENT OF CAPITAL: MUNICIPAL ELECTRICITY WORKS IN LONDON.

By "INTERESTED."

At the present time the indebtedness of these municipal electricity supply stations is increasing too fast, and, unless a distinct alteration is made in the present system of taking up loans and of repayments, the near future will land some of them in a sore dilemma. The sinking fund is still growing up at a good pace, and it is now high time the debt ceased growing and commenced declining. Perhaps I should apologise for again referring to this subject, but I am not going to do so, because I consider the question one demanding ventilation.

Let me revert to the commencement or birth of these departments, and review the conditions governing the capital borrowed from the sanctioning authority—the London County Council. In the early stages the periods fixed for repayments were as follows:—Freehold land, 60 years; buildings, culverts, and bare copper mains, 50 years; meters, 10 years; and 20 years for all other purposes. At the start of a works the usual custom was to take the items collectively and make one general loan for the whole. The usual term for such a loan was 42 years. When a general loan of this description was taken up, the lending authority required the borough council to pass a resolution to the effect that all renewals and replacements should be made, during the currency of the loan, either out of revenue or from a sinking fund created for that purpose. At a later date—November, 1906, to be exact—the Council revised the periods for repayments and decided upon the following maxima: Freehold land, 60 years; buildings, 50 years; mains, 30 years; plant, 20 years; house connections (excluding meters), 12 years; and meters, 10 years. Another revision within the next few years would not come as a surprise. Outside London, the usual average maximum fixed by the L.G.B. is 25 years.

Now, in the beginning, the long-period loans proved a blessing in disguise, and materially assisted the undertakings by keeping the amount of redemption low. Had the present-day maxima then been in force, the stations would have experienced considerably more trouble in making both ends meet. In their infancy the stations benefited by this privilege, I might say, of small annual repayments, but at the present date, when most of them are nearing maturity, what is the effect of that privilege? Remember that the borough councils have resolved to pay for all renewals and replacements out of revenue. The answer is clear. Sufficient profit must be made each year to cover the small amount redeemed; pay a yet tall sum for interest on the large amount of capital out-

standing ; and put by sufficient for probable replacements and renewals in the near future. What at first appeared a blessing proves at this juncture to be somewhat of a handicap, and looks like hampering the undertakings in the future, because the interest charges will remain heavy for many years to come. I certainly think that the sum set aside for replacements and renewals is not sufficient for the purpose.

The annual return prepared by the statistical officer of the L.C.C. (P. S. King & Son, price 1s.) gives a wealth of detail and much food for thought in this connection, and the following figures, abstracted from the last report issued (1907-8), are well worth consideration :—Total amount borrowed, £5,907,163 ; total repayments, £508,757 ; total outstanding, £5,398,406 ; proportion repayment bears to amount borrowed, 8·6 per cent. Since the commencement of the undertakings, the contributions made in aid of local rates are £36,695, and the sum taken from the rates in aid of the undertakings is £121,459. Already devoted to replacements or written off capital expenditure, £107,617 ; balance at Cr. of renewals or reserve, &c., funds, £126,702, and at net revenue account, £54,252.

These figures speak for themselves. When a station has been in existence for something like 10 or 12 years, the above-mentioned proportion should be higher than an average of about 8½ per cent. Financially some stations are in more favourable positions than others, and are, comparatively speaking, safe, but that cannot be said of the majority. A large sum has already been expended in renewals and replacements, or written off the capital. Thus, within 12 years from the commencement, replacements have become necessary, and some of the original installation has been scrapped or sold. Another few years will necessitate expenditure of a much higher figure for the following reason :—No station would be originally designed in such a manner as to require renewals or replacements within, say, five to six years from the start ; therefore, it is evident that the above-mentioned sum has been spent in the last five or six years, and ordinary reason says that that sum will develop into a larger one in the immediate future. True, nearly £181,000 is in hand for this purpose, but that cannot be confidently expected to grow to any appreciable extent when constantly increasing sums are required for redemption and interest.

This question of repayment of capital should be approached from a public point of view, quite apart from any personal or party feeling. I do not care a straw for the ravings of some people over municipal trading, taking that on the whole. Facts are recorded, and figures can be obtained with but little trouble, so, if they choose to be optimistic in this particular respect—municipal electricity works—they are at fault. Many of those interested—more or less—in this matter argue that a point will shortly be reached when borrowing will cease, and from that time onwards the debt will annually be reduced until finally extinguished. That is the hypothesis. When will that point be reached ? Can any fact be found in the published accounts pointing to the probability mentioned ? The figures given in the L.C.C. return fail to give any clue, and the annual accounts published from time to time in those journals devoted to the electrical industry also fail to elucidate matters in this respect.

We have, without doubt, a mortgage debt increasing at a time when it should be falling off, notwithstanding the heavy repayments being made, and, incidentally, the sum drawn annually from the rates in aid of some concerns. Quite apart from the money taken from the rates, there are a few instances where certain sums have been paid in aid of the local rates. I consider that a step in the wrong direction. A far better and safer course would have been to place the surplus in a renewals, depreciation or reserve fund. The undertakings are not at present in a financial position strong enough to submit to such a drain, and, sooner or later, will feel the drought. In these hard times a little relief is very welcome, and councils must be excused for occasionally taking the surplus from the electricity department to assist the local populace, but that practice must on no account become general.

To a certain extent the recently inaugurated custom in some districts of taking up loans repayable over short periods, *i.e.*, less than the maximum period allowed by the L.C.C., is a step in the right direction, and might be extended with advantage. Also, some form of consolidation scheme whereby various loans are grouped together, so as to shorten the period of repayment for some of the original ones, might be adopted. Were councils to persist in taking up their loans on a short repayment scale, and to put all surplus on one side for the purpose of replacing plant, &c., which becomes obsolete or inefficient owing to the installation of larger units or modern improvements, and for renewals, then the matter would be well taken in hand, and the sinking fund might really sink. The burden would become a heavy one after a few short-period loans were obtained, but the load will have to be tackled soon in order to safeguard the future.

Speaking generally, the ratepayer seldom takes much interest in the local electricity supply works. Occasionally a few remarks on his rate notice may serve to fan into a glow some few sparks of thought, but thinking of just how and when he can meet the demand soon damps them again. By some means he should be induced to watch the figures, and weigh up the pros and cons for himself. Then, perhaps, the future position of the electricity department would receive a greater share of attention from those elected to manage the undertakings. Perhaps, after all is said, the auditor will, by dropping a gentle hint in his report, be the means of awakening the management, and show them what a serious outlook the future has, and that immediate attention is required on their part.

A SLIPWAY HAULAGE GEAR FOR FRANCE.

An electrically-operated winch was recently built by Messrs. Clarke, Chapman & Co., Ltd., of Gateshead-on-Tyne, for an important French firm of contractors. It is designed to haul a load of 30 tons at the rate of 5 ft. per minute by means of chain cables, and is, therefore, capable of dealing with medium sized vessels. Its overall dimensions are only 10 ft. 3 in. × 11 ft. 6 in. × 6 ft. 3 in. high. The economy in space and material is effected by introducing chain cable lifters as used in windlasses, in place of the usual drum for use with steel ropes. The effective diameter of the cable lifter is 2 ft., and the cable as drawn over the lifter is dropped into a tank, as in the case of anchor cables on board ship.

A drum to accommodate a rope, which would be nearly 2 in. in diameter, would have to be 6 or 8 ft. in diameter in order to avoid bending the rope too sharply, and as a wire rope of such a size

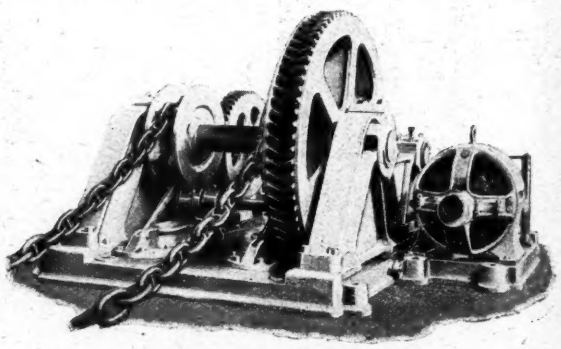


Fig. 1.—View of Motor and Chain Wheels.

could not lie in more than one layer on the drum without speedy damage, the drum would be fairly wide for any suitable length of slipway. Moreover, the large diameter of the drum would involve considerable extra speed reduction to avoid installing a very low-speed motor, and this would again bring up the cost of the plant.

The chain wheels are of cast-steel, fitted with snugs carefully pitched to give easy running of the chains. They are keyed to a massive shaft, operated by a double helical spur wheel of cast-steel. The pinion rides loose on its shaft, and is engaged with it by means of a strong steel clutch when it is required to haul by means of the chain lifters. The shaft carrying this pinion is driven by worm gear, totally enclosed in a cast-iron box filled with oil, and fitted with a roller bearing to take the thrust of the worm. The worm wheel is of special construction, consisting of a gun-metal machine-cut rim bolted to a cast-iron centre, the idea being to avoid the development of any slackness of the wheel on the key in the course of operation, while securing the advantage of the gun-metal teeth. The worm is of steel, cut from the solid, on a shaft coupled directly to the motor spindle.

It is frequently convenient, in order to give a start to the vessel which has been docked for repair, for manipulating the cradle, or other purposes, to have a warping gear which can be operated independently of the main haulage. This is provided in this instance by attaching a warping drum to the clutch pinion shaft, 26 in. in diameter, and having a warping speed of 45 ft. per minute.

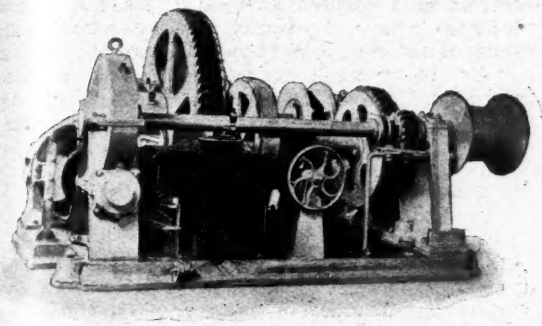
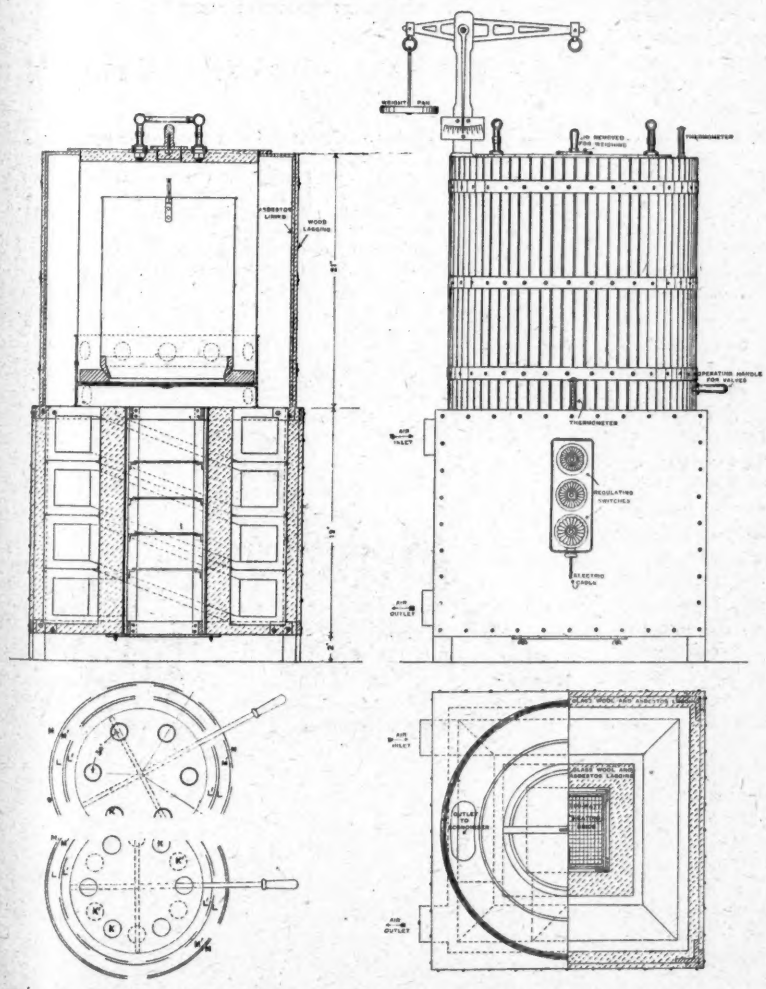


FIG. 2.—VIEW OF CONTROLLING GEAR.

In order that the carriage may be held still while the warping drum is used, the chain lifters are disconnected from the motor by means of the clutch, and a powerful band brake is provided, having hardwood blocks, operating on the intermediate shaft and controlled by a screw and hand wheel. There is also on the motor spindle a post brake operated by a foot lever, capable of holding the greatest load that the motor can pull by means of the warping drum.



Alternative Positions of Air Valves.

ELECTRICAL CONDITIONING OVEN, EXTERIOR AND SECTIONAL VIEWS.

The electrical part of the equipment consists of a four-pole series-wound Clarke, Chapman motor, having a totally enclosed slot-wound drum armature. The motor runs at 750 R.P.M. on a 550-volt circuit, gives 27 H.P., and is designed to have a temperature rise of not more than 100° F. on a run of one hour at full load. It is operated by means of a controller capable of speed regulation by means of cast-iron grid resistances. The controller, foot levers for brakes and clutch lever are all grouped at the end of the winch, so as to be under the control of one operator. Our illustrations show the general appearance of this interesting gear; fig. 1 is a view of the motor drive and cable lifter, while fig. 2 shows the control side of the gear, including the drum controller for the motor, band brake hand wheel, foot levers, and clutch for the chain lifters.

AN ELECTRICAL CONDITIONING OVEN.

THE object of this apparatus is to ascertain the percentage of moisture in any fabric which might be considered hygroscopic, as the presence of moisture not only affects the weight, but also the strength of the material. For instance, with regard to the sale of wool, either in the raw state or otherwise, it is obviously necessary for the purchaser to satisfy himself that he is paying for wool, and not for wool and water; then again, when a merchant desires to buy cloth, he not only considers the appearance and weight of it, but is careful to test the strength of it. This is done by straining various samples of equal length and width between two jaws, the one fixed and the other moving along a screw, to which is attached an indicator which records the breaking strain in pounds.

It is obviously unfair to the better class of cloth manufacturers for the merchant to ignore such a test as this, and it is just as unfair that such a test should be carried out unless the cloth has first been conditioned, as there are many cloths which have a lower breaking point when wet than dry.

The conditioning oven ensures that the fibre or cloth is free from moisture, or at any rate, that the percentage of moisture remaining is such as to be a negligible quantity when considering weight or strength.

The object of all conditioning ovens is the same, but their construction differs slightly owing to the heating medium, which up to the present has been confined to gas or steam. The steam oven is used only where a supply of steam is available for power or heating purposes, but where steam is not available gas is used. The efficiency of the gas-heated oven is naturally low, as the air passing through the wool must not be in contact with the flame or fumes; it is usually passed over a series of large copper plates on its way to the conditioning tank; this means, then, that by far the greater percentage of heat passes away to the atmosphere.

In most modern gas-heated ovens the hot air is driven through the wool by means of a fan or blower at a pressure such as will ensure that all moisture is taken away with it. Obviously, if electric heating was applied in the same way, the expense would prohibit its use; but, owing to the fact that the air comes in direct contact with the heating element in the new design, the efficiency is very considerably increased.

Referring to the plan, the rectangular-shaped box in the centre contains a number of woven-wire resistance mats arranged horizontally one over another. Surrounding this, and insulated from it by slag wool, is a chamber (also insulated on its outer surface) which is really a spiral surrounding the heater. In this spiral, which is square, is a 3 in. by 3 in. tube, which is also a spiral. These tubes form the economiser of the apparatus. Air is blown through the smaller tube by a fan, entering at the top, into the bottom of the heater, then up through the wire mats into the space at the top. From this point, by means of a series of ports, the air may either be directed through the wool, which is contained in the conditioning tin, or by-passed into the annular space surrounding the oven, and thence down into the larger tube of the economiser. The latter method is adopted when the weighing operation takes place, as it would obviously be impossible to weigh the material with a pressure of air under the tin; furthermore, it is not advisable to switch the current off, as even while weighing takes place it is necessary to maintain the air temperature in the oven as near the normal as possible, as otherwise the fabric would absorb moisture from the atmosphere, and so give a misleading result.

The material rests in the tin on gauze or perforated zinc of small mesh, and the usual quantity used for conditioning is ½ lb. This sample is taken from the inside of a bale indiscriminately, and the percentage of moisture in the sample represents the percentage of moisture in that particular bale. Directly above the tin there is a sensitive scale, and it is customary to keep the scale balanced throughout the test by adding weights on the wool side to make up for the loss of weight due to evaporation.

The whole apparatus is designed in a manner which ensures the highest possible efficiency, and that the result aimed at has been attained is easily proved by noting the temperature of the air at the outlet. The temperature of the oven is maintained at 220° F. throughout the test, and yet the outlet temperature is but a few degrees above that of the inlet, and the difference can only be noted by taking a reading on a thermometer. This proves the value of the economiser, which, it will be noted, is similar in principle to a feed-water heater. A motor consuming about 60 watts is quite large enough for driving the necessary amount of air through the oven; the heaters consume only one unit per hour, so that the cost for energy is but small, and is, in fact, less than that of gas in the most recent type of gas-heated ovens.

As most modern textile mills are fitted with electrical plant, there should be no difficulty in adopting this type of oven generally, but even if no supply is available, it is a simple matter to run a small dynamo off the line shafting, to which also the fan could be coupled. In such a case the dynamo would merely replace the motor; the extra cost, therefore, of such an arrangement would be small.

One great advantage that this oven has over the gas-heated oven is that it is ready for use in five minutes, whereas it takes from 30 to 45 minutes to thoroughly warm up the other, owing to the fact that a large mass of copper or other metal has to be heated up before the air-blast can be applied. It has many other advantages, the chief of which are:—

It is compact.

It may be moved from place to place, and used without trouble, so long as there is a supply of current available, and a plug and flexible.

The temperature regulation is perfect, and may be controlled either by regulating the amount of air or by switching the current on or off.

It may be used on alternating or direct current at any medium pressure.

The apparatus described has been developed by Messrs. Ellis and Allsopp, of the Bradford Corporation electricity department, and it is bound to interest central-station engineers, especially those in the woollen and worsted districts.

ELECTRIC CHAFING DISHES.

By FREDERICK M. WEST.

Chafing-dish cookery is of quite early origin, and is principally used in the preparation of those dainty omelets and sauces so beloved of the French. It is in America, however, that it has become most popular, and, probably driven by the acuteness of the servant problem to do much of her own cooking, the American housekeeper has taken fuller advantage of the comfort and pleasure derived from this and similar appliances. It must not be imagined that chafing-dish cookery is a fad; it is extremely practical, so much so that the well-known cooking expert, Mr. Herman Senn, has issued a book on "Chafing-dish and Casserole Cookery," which contains upwards of 80 recipes for the

Chafing Dish in Use.

chafing dish alone. The following items convey an idea of its possibilities:—Kedgeree of fish, fried scallops, soles à la Parisienne, lobster patties, réchauffé of cold meat, fish toast, chicken croquets, kidneys à la minute, mutton cutlets à la minute, tripe with cream sauce, Welsh rarebits, &c.

The chafing dish consists of a heater, a water pan, a blazer, and numerous accessories such as egg poachers, forks, &c., all of which would find a place in the most modest of kitchens. The part that the cooking is done in is the blazer, which is used in the same way as the upper part of a double boiler or porringer for scalding milk, the essence of the thing being the cooking over hot water. Most chafing dishes at present in use are heated by alcohol, but little difficulty should be found in showing the advantages of electricity over spirits. The cost for energy is low, many of the operations taking only 15 or 20 minutes; a long one, for instance, soles à la Parisienne, taking under half an hour, would cost about ½d. with electricity at 1d. per unit.

A useful service is in the preparation of supper dishes; these can be partially cooked, and then completed upon the return of, say, a theatre party, and a warm supper, perfectly cooked, enjoyed without troubling the servants. Its value in a sick room for heating milk, &c., is obvious; also the water pan can be used separately as a saucepan.

The price is about 40s., and they are usually rated at 200 watts for the low heat and 600 watts at full heat. They form useful presents, and would well repay pushing, as their use would do much to advertise the convenience, practicability and low cost of electric cooking.

AN ELECTRICALLY-OPERATED TURBINE FIRE-PUMP.

[BY OUR BERLIN CORRESPONDENT.]

The voluntary fire brigade of Wiadhofen-on-Ybbs, Austria, has recently adopted a novel type of electrically-operated fire engine, designed as a four-stage high-pressure turbine pump.

This pump is able to throw upwards of 400 litres of water per minute through two lines of hose to 40 metres distance, and comprises a cast-iron housing, bucket-wheels, a nickel-steel shaft, and two ring-lubricated bearings. The shaft is perfectly balanced in regard to axial thrusts, and is coupled by an elastic clutch to a 10-H.P 150-volt three-phase motor with slip-ring armature.

The pump, motor and accessories are mounted on a four-wheel car fitted with excellent springs. This car contains in its forepart seating accommodation for four men, and in the rear standing accommodation for three, care being taken to reduce the dimensions and weight of the car while providing room for as many passengers as possible, and rendering operation as easy as it can be made.

Immediately beside the motor is located the motor starter, a three-pole lever switch with fuses, and between the pump and motor the amperemeter, carried by an iron fork. Below the electromotor there is fixed to the underframe of the car a cable drum fitted with three slip-rings and three pairs of carbon brushes. This cable drum is operated through a simple hand-crank fixed to an extension of the shaft. The motor is protected against moisture by a half-round sheet metal case.

The pump motor is connected to the electrical mains by means of plug contacts, or by hook couplings consisting of metal hooks roughened on the inside so as to remove the oxidised skin of bare conductors and to obtain a satisfactory contact. From these couplings, which are fixed to three-part bamboo rods of about 6 metres total length, a flexible cable of 60 sq. mm. section and about 10 metres long, terminating in a well-insulated three-core rubber-insulated cable of 3 × 60 mm., with galvanised-iron wire sheathing, leads to the engine. Hook contacts are used only in connection with overhead conductors, and are readily fixed at any point of the line without any disturbance in the service. Plug-contacts are mainly used in connection with underground circuits, the necessary contact boxes being installed close to the water hydrants.

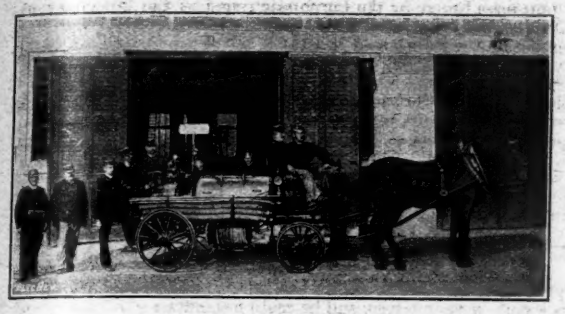
Being able to carry a length of cable of several hundred metres, the pump can be operated, within certain limits, at any place desired.

Two ordinary candle lanterns are used to light the pump on its way to the site of the fire; two 32-C.P. electrical incandescent lamps in each of the lanterns, as well as an incandescent lamp fixed above the amperemeter, are connected to the circuit during the operation of the pump.

A special electrical detachment of the fire brigade has been organised for handling the pump and carrying out any

work required during fires for the prevention of accidents and breakdowns in service.

On the occasion of public tests recently made, a jet 60 metres in height was thrown, 1½ minutes after arrival.



Electrical Fire Pump.

The main advantages of this fire engine, which has been designed by Herr J. Reiner, manager of the Waidhofen municipal electricity works, are as follows :—

Increased rapidity in getting into working order; reduction in first cost, weight and space requirements; increased simplicity and safety in operation (due to the absence of any complicated driving gear or valves); reduction in the wear and tear, and cost of operation, the current being in most cases derived free of charge from the city mains.

For smaller outputs, the same type of fire engine could be mounted on a two-wheel barrow handled by one man, and would constitute an excellent fire extinguisher for factories, store-rooms, farms, theatres, &c.

AN AERIAL ROPEWAY INSTALLATION.

We illustrate herewith a novel and expeditious method of automatically disposing of waste ashes from steam boilers, as installed by Messrs. Richard White & Sons, engineers, of

Fig. 1.—Automatic Ash Tipper.

Widnes, for the Sheffield Corporation at their Neepsend generating station.

Some time ago, Mr. S. E. Fedden, the city electrical engineer, with a view to adopting the best means of distributing the ashes from the boilers, and utilising these ashes for the purpose of filling up some waste ground, advertised in all the leading technical papers for estimates for the work, each firm competing to submit their own scheme for the duty required. Messrs. White's proposals and drawings were selected after careful consideration of a large number of propositions submitted by the leading conveying firms, not only of this country, but also from America and the Continent, so that the matter assumed a kind of international competition, and it is gratifying to think that British enterprise and invention were found equal to the occasion.

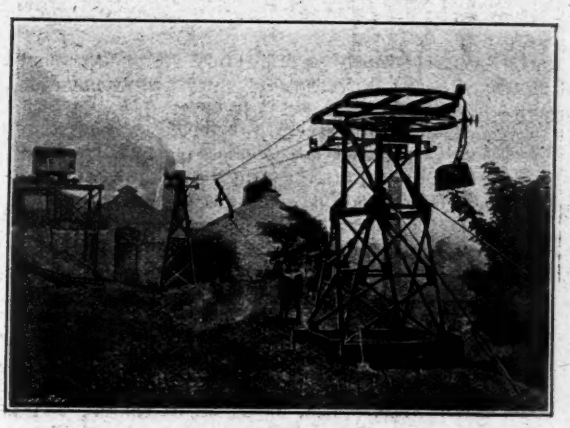


Fig. 2.—Return Terminal for Ropeway.

It will be seen that the plan adopted is an aerial wire ropeway on Messrs. White's patent principle, with automatic tipping of the ashes wherever required, as clearly shown in fig. 1, whilst the empty carriers proceed onward without stopping or being handled in any way, and are automatically conveyed around the return terminal, as shown in fig. 2, so that the carriers are never touched by hand after leaving the loading rail, until they arrive back again at the loading terminal, where they are automatically disengaged from the hauling rope, and then stand ready for loading again, as shown in fig. 3.

In order not to interfere in any way with ground traffic, it was found necessary, in the first place, to elevate the loading rail of the installation to a height of 17 ft. above the ground level. The ashes are collected in the basement

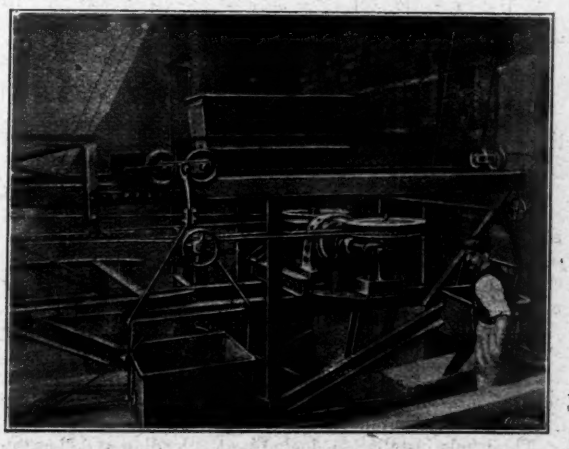


Fig. 3.—Loading Terminal at Boiler House.

underneath the boilers in ordinary tipping wagons, each wagon holding ¾ cb. yd. of material, and running on a light tramway of 2 ft. gauge. The wagons are then run to an electric hoist just outside the boiler house, by which they are raised to a height of 40 ft. above the basement level. Here the contents of the wagons are tipped into a hopper of 54 cb. ft. capacity, the arrangement being clearly shown in the accompanying view.

From this hopper the ashes fall through a shoot, controlled by a hand lever, into the boxes of the ropeway carriers standing on the loading rail.

The carrier is then engaged with the hauling rope by means of the patent gripper provided, which conveys the load along the ropeway as shown in fig. 4, until it reaches the automatic tipper, as already described.

Fig. 4.—Ropeway, showing Intermediate Support.

The hauling rope, which, of course, is endless, and is constantly running when the ropeway is at work, is driven by means of an ordinary fleeting wheel, which is connected with worm gearing, driven by an electric motor.

The loading terminal is of special design, with a loading rail curved to an exact circle, so that the terminal itself can be readily turned round to face any part of the tipping ground without interfering with its position with respect to the loading hopper, a central pivot maintaining its correct alignment.

The automatic return terminal is mounted on eight steel wheels running on a pair of rails, as shown in fig. 2, so that as the ground around it is filled up in course of time by the tipping, the terminal itself can be moved along. In this way it will be seen that the whole installation can be moved round fanwise for a total length of 190 ft., so that in time the whole of the low ground to the left of the ropeway will be automatically filled up. The whole of the hauling rope sheaves are mounted on roller bearings, and only occasionally require lubricating, whilst an automatic lubricator on one of the carriers provides for keeping the carrying ropes properly lubricated.

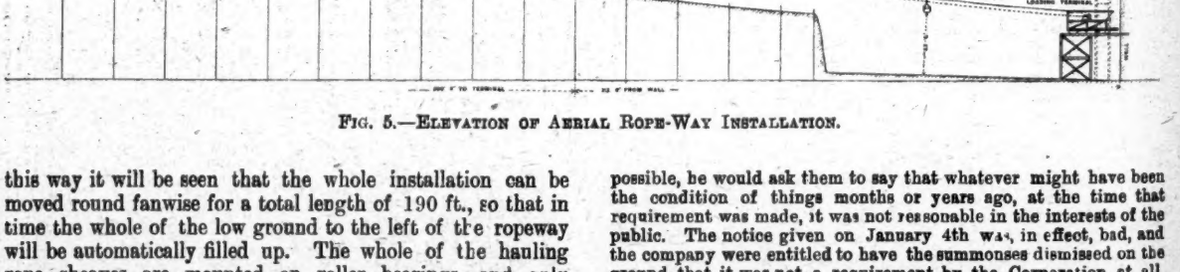


Fig. 5.—Elevation of Aerial Rope-Way Installation.

The carrying ropes are of lock coil construction, giving easy and smooth running to the carrying sheaves, whilst the standard (see fig. 2) is provided with White's improved form of rope saddle, giving a long bearing for the carrying rope with easy running of the carrying wheels.

The whole installation, including the loading and dispatch of the carriers, is worked by one man, so that it will be seen that the actual cost of disposing of these ashes is exceedingly small.

Westminster Electric Supply Corporation, Ltd.—The directors have declared an interim dividend for the half-year to June 30th at the rate of 10 per cent. per annum, less income-tax, as last year.

LEGAL.

Devonport Corporation *v.* The Devonport and District Tramways Co.

At Devonport on Wednesday and Thursday last week, the 155 summonses issued by the Corporation against the Devonport and District Tramways Co., with regard to the discontinuance of the service on the lines leased by the Corporation to the company, came before the Borough Magistrates. Seventy-one summonses were for failing to run at least four cars each way in the morning and in the evening, at the hours thought by the Corporation most convenient for artisans, mechanics, &c., on the lines leased to the company in pursuance of a certain agreement, from January 18th to April 10th, 1909. Eighty-four summonses were for failing to comply with a lease, &c., by not providing on the leased lines such cars as were reasonably required by the Corporation in the public interests from January 17th to April 10th, 1909.

Mr. R. J. Fittall (town clerk) appeared for the Corporation, and Mr. Eustace Hills for the company.

Mr. Fittall proposed an arrangement for abbreviating the proceedings, but Mr. Hills said that important questions of principle were involved, and he could not make any admission such as Mr. Fittall asked.

Mr. Fittall asked for judgment upon the whole of the summonses. He proceeded to detail the circumstances which led to the discontinuance of the service on the leased lines since January 16th last, particulars of which have already been published in these columns (June 25th). He said the company contended that through financial disability they had been unable to comply with the notice given by the Corporation. It was an important matter that the ratepayers of the borough, who had £62,000 invested in the leased lines, should not have those lines lying idle in the streets. During the six months since the cars ceased running upon the leased lines, the company's takings had decreased £2,445, or £94 a week, compared with the corresponding period of last year. If the company were not willing to run a service on these lines, and the Bench agreed with the contention he put before them, and also agreed that the requirements of the Corporation were reasonable and in the public interest, he would ask them to impose the maximum penalty of £5 a day, because of the great public inconvenience caused. This was the only effective remedy that the Corporation had against the company.

Evidence for the Corporation was given by Mr. Rupert Royle (assistant town clerk), Ald. Tozer (chairman of the Tramways Committee) and Mr. C. R. Everson (manager, Plymouth Corporation Tramways, who considered that the service required by the Corporation was reasonable in the interests of the riding public).

Mr. Hills addressed the Bench for the defence. The only thing they were concerned with, he said, was whether the Corporation were entitled to the penalties they were seeking. If the Bench found that the requirements could only be complied with at very serious financial loss to the company, so as to be to a trading company practically impossible, he would ask them to say that whatever might have been the condition of things months or years ago, at the time that requirement was made, it was not reasonable in the interests of the public. The notice given on January 4th was, in effect, bad, and the company were entitled to have the summonses dismissed on the ground, that it was not a requirement by the Corporation at all. There was no resolution of the Corporation until January 14th. The notice being bad, and being the foundation of the proceedings, the company on that account were entitled to a decision in their favour. It was clear that whatever might have been the condition of things in 1904, 1905, or 1906, on January 17th, 1909, taking all the facts into consideration, it was not a reasonable requirement in the interest of the public to ask the company to provide a 60-minute service between three places which had had no effective service—some no service at all—since November, 1905. As regards those three services, it was certainly not reasonable, and if not reasonable in regard to those services, it was a requirement upon which criminal proceedings could not be based, because the document must be reasonable as a whole, or it failed. Until they took over these extensions in 1903 the company carried on a profitable undertaking. It had been said that the lease was voluntarily entered into, but it was under threat of competition that the company took over the extensions and agreed to pay the rent.

Mr. Walter Bond (chairman of the company) said that as the result of the first year's (1902) working of their own lines, apart from the extensions, they were able to declare a dividend of 4 per cent., and put by sums for renewals. In 1902 the gross revenue was £6,990, and in 1904 (the first complete year with extensions) £8,636, an increase of £1,646. Against that increase there was the Corporation

rent of £3,900, so that the extensions failed to pay their way by £2,254. Speaking generally, the deficiency on the extension had increased since 1904. The share capital of the company was £132,000, and the British Electric Traction Co. held the major part.

Mr. Durnford, engineer and manager to the company, gave details of the service, and said that the company were distinctly better off through the service on the extensions being discontinued. The total saving through being without the extension had been about £116 per week since January 17th. The service prescribed by the Corporation was neither reasonable nor possible. The loss on the line between St. Budeaux and Saltash passage was just under 1s. per mile.

Mr. P. N. Gray, secretary of the company, having given evidence,

Mr. Fittall addressed the Court on points of law.

The 71 summonses relating to workmen's cars were next dealt with, and the Chairman announced that the Bench would communicate their decision at a later date.

Blackwell & Co. *v.* The Mayor and Corporation of Derby.

In the Court of Appeal, before Lords Justices Moulton and Buckley last week, this case was heard on the appeal of the plaintiffs from an order of Mr. Justice Bucknill in Chambers staying the action under Sec. 4 of the Arbitration Act.

Mr. Atkin, K.C., for the appellants, said that the question was whether the Judge in his discretion was right in staying the action on the ground that the contract between the parties contained an arbitration clause, under which disputes arising under the contract were to be referred to the arbitration of the borough engineer of the Corporation. The plaintiffs were electrical engineers, and the contract was for the construction of an electric tramway in Derby. The borough engineer had certified for certain penalties in respect of alleged delay in the completion of the contract, and the plaintiffs' case was that the delay arose from the arbitrary conduct of the borough engineer himself in, as alleged, directing the work to be done in a certain manner and materials to be obtained from specific firms, and in refusing to permit the plaintiffs to store material required for the work in certain places. The action was brought by the plaintiffs to recover the balance alleged to be due under the contract. Counsel submitted that Mr. Justice Bucknill was wrong in staying the action, inasmuch as the dispute was not one which ought fairly to be referred to the arbitration of the borough engineer, who, in order to arrive at a conclusion, would have to sit in judgment upon himself.

Mr. Danckwerts, K.C., for the defendants, supported the order of the Judge, submitting that the dispute in question was such as must have been in the contemplation of the parties when it was agreed that the borough engineer should act as sole arbitrator. The authorities showed that an arbitrator appointed under a contract was only displaced and the jurisdiction of the Courts called in aid, when it was shown that the arbitrator was likely to be biased or that he had been guilty of misconduct, such, for instance, as receiving bribes. In the present case the *bona-fides* of the borough engineer could not be attacked, the only suggestion being that as he had certified for penalties, as he was entitled to do under the contract, he was not a fit person to arbitrate on the dispute. If it were sufficient, in order to oust an arbitrator, to say that he would be sitting in judgment upon himself, then contracting parties might just as well treat arbitration clauses as so much waste paper.

Lord Justice Moulton said that the Courts in exercising their discretion must look at the facts of each particular case.

Mr. Danckwerts contended that Courts ought to act on fixed principles, and that having laid down certain principles they ought to be true to them, and people in entering into such a bargain did so with knowledge of those principles and in the belief that they would be supported by the Courts.

Lord Justice Buckley asked whether Mr. Danckwerts thought that a person who was accused of being unreasonable was the best judge as to whether he had in fact been unreasonable.

Mr. Danckwerts replied that when the parties made the contract they must have known that in a dispute relating to penalties the conduct of the engineer must necessarily be largely in question. Invariably in cases where there was an allegation of delay the contractor turned round and said that delay was due to the acts of the employers. He submitted that, in such cases, the jurisdiction of the engineer, as arbitrator, ought not to be ousted.

Lord Justice Moulton, giving judgment, said that there was no doubt with regard to the law to be applied in this case. In older days, an agreement to refer disputes to domestic tribunals was not enforceable, but the Legislature had since recognised that such an agreement was part of the contract, and that it would not be fair if it did not, to a certain extent, enforce arbitration clauses. But it wisely took this course—it gave a right to a person against whom an action was brought to come to the Court and ask for the action to be stayed under the Arbitration Clause in the contract sued upon. The person so coming to the Court had to prove that he had always been ready and willing to go to arbitration, and then the Court had power, under the Common Law Procedure Act, to stay the action if it saw no good reason why the matter should not be disposed of in the way the parties had contracted. But each case had to be raised on its own facts. In his Lordship's opinion, where the nature of the dispute arising from facts which were subsequent to the contract was such that the Court thought that the arbitrator was not likely to be able to deal impartially with the dispute, it was open to the Court and it was their duty to refuse to enforce the arbitration clause. It was suggested that this ruling would make arbitration clauses useless, but the Courts were quite able to judge what was the subject of the dispute, and they would not be misled by unfounded allegations. In the present case he was satisfied that the dispute was substantially whether the borough engineer from the first acted unreasonably towards the contractors from the point of view of the contract. Corporations were, in his Lordship's opinion, too fond of putting officers of their own in the position of engineers under a contract, and they forgot that as the officer had to perform other duties for the Corporation, there might arise conflicting interests between those duties and his duties under the contract which might give rise to unfair treatment of the contractor by reason of the zeal with which the officer performed those other duties. In the present case he was of opinion that the Court would not be acting in the spirit of the law if they were to shut the doors of the Courts to the action and force it to be referred to arbitration. He was satisfied that there was a substantial dispute arising out of events which occurred subsequent to the making of the contract, and he did not think they ought to force it to be tried by the engineer whose conduct was practically the sole point in dispute.

Lord Justice Buckley concurred. He said that he did not in any way reflect upon the engineer, but in the circumstances he did not think he was the proper person to determine the dispute.

The appeal was accordingly allowed, with costs, and the order staying the action set aside.

Phythian *v.* Liverpool Corporation, &c.

At the Liverpool Assizes on July 28th, the action of Phythian *v.* the Liverpool Corporation and Woolton Motor-'Bus Co., Ltd., came on for hearing, being a claim by Mrs. Phythian, of Wallasey, to recover damages for personal injuries sustained as a result of a collision between a motor-'bus belonging to the company, and an electric tramcar belonging to the corporation. Counsel appeared on both sides, and the main point was whether the Corporation or the company were to blame for the collision. The case for the plaintiff, as put forward by Mr. Greer, was that on March 31st, Mrs. Phythian entered a motor omnibus at the usual stopping place opposite the Coffee House Hotel, Wavertree, and that just before it started, the tramcar collided with the rear of the motor-'bus. As a result of the impact, the plaintiff was rendered unconscious and remained in that condition for three or four days, and suffered from shock and headache. She had to call in two medical men, and go to North Wales, and she was not able to take that part in her husband's business of fruiterer that she formerly did. The case for the Corporation was that the accident was brought about through the omnibus drawing suddenly and without warning on to the tramlines in front of the tramcar. Mr. Tobin submitted on behalf of the company that the accident was the fault of the tramcar driver in not pulling up quickly enough in view of the danger of a collision. At the resumed hearing on July 29th, the plaintiff's right to compensation was admitted by the two defendants, and the foreman subsequently announced that the jury had found a verdict for £141 12s. against the Liverpool Corporation.

The Judge: You do not find any verdict against the company?

The Foreman: No.

Clarke *v.* the Mayor, &c., of West Ham.

In the Court of Appeal, on Friday last, the Master of the Rolls and Lords Justices Farwell and Kennedy delivered judgment in this case on the defendants' application for judgment or new trial in the action which was tried before Mr. Justice Coleridge and a common jury. The circumstances and the trial were fully reported in our issues of March 5th and April 30th last. At the trial the jury awarded the plaintiff £500 damages, and Mr. Justice Coleridge held that the plaintiff was entitled in the circumstances of the case to the damages awarded to him, and entered judgment for the plaintiff for £500 and costs. The defendants appealed upon the grounds that the judge should have entered judgment for them, having regard to the sum paid into Court and that the judge had misdirected the jury by telling them that it was open to them to assess a greater amount of damages than £25, and in directing them that the defendants had broken Regulation 12 made by the Board of Trade.

The arguments on the appeal concluded on July 16th, when judgment was reserved.

The Master of the Rolls, in delivering judgment, recited the circumstances and said that the first and main point to be considered was whether there was an obligation upon the defendants to carry a member of the public, not being an objectionable person, who desired to enter a car in which there was a vacant place: or whether the defendants were under no such obligation, but at liberty to refuse to take any one except upon such conditions as they thought fit to impose. In his opinion there was such an obligation upon the defendants; the plaintiff had a right, on paying or offering to pay his fare, to travel in the tramcar. The undertakers were empowered to do that which would otherwise have been a nuisance to lay rails along the highway; it was in the nature of a franchise granted by Parliament. Parliament had allowed the levying of tolls, which again seemed to him to negative the idea that the defendants could pick and choose their passengers. Moreover, the by-laws, which had statutory effect, strongly supported this view. It followed that the right conferred upon the plaintiff was a right to be carried on payment of the published fare—namely, one halfpenny, and that there was no justification for qualifying the plaintiff's right by the addition of a term limiting liability for negligence to £25. It might be, though he hesitated without further

argument so to hold, that if the defendants had chosen to publish two lists of fares in their carriages, one of which contained their maximum rates and the other of which contained reduced rates, and an option were given to a passenger to pay either the full rate without any limitation of liability or the reduced rate with a limitation of liability, a passenger electing to pay the smaller fare would be bound by the terms on which, and on which alone, the reduced rate was accepted. In that case there might be consideration for the limitation of liability, but in the present case it seemed to him that no option was given to the plaintiff. The plaintiff had paid the only fare which the defendants could demand, and the defendants were no more entitled to limit their liability to £25 than they would be to negative all liability for negligence. In his opinion it was not useful to refer to provisions contained in the Railway Acts or to cases decided under those Acts. He based his judgment on the simple proposition that the plaintiff, who had a right to be conveyed in a tramcar on payment of the published fare, enjoyed that right with everything incidental to it, including a right to such damages as a jury might assess by reason of the defendants' negligence. He thought that the appeal failed, and must be dismissed with costs. The Lords Justices also delivered judgment dismissing the appeal.

A stay of execution was granted pending an appeal to the House of Lords, on the terms that the plaintiff was to have his costs in the Court below and in the Court of Appeal taxed and paid him in any event, and that the defendants should pay him £1 a week till the hearing of the appeal.

MORRISON *v.* THE BRITISH ALUMINIUM CO., LTD.

IN the Chancery Division on Friday (July 30th), Mr. Simmons for the plaintiff, in the action of Morrison *v.* The British Aluminium Co., Ltd., informed Mr. Justice Warrington that the motion in the case for the appointment of joint receivers would, subject to his Lordship's sanction, and with the consent of counsel for the company, stand over till the second motion day of next sittings.

His LORDSHIP allowed the motion to stand over accordingly.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Reyrolle Flame-Proof Drum-Type Starters.

In view of the recent correspondence in our pages on the subject of mining switchgear, the accompanying illustration of a new type of flame-proof motor starter, recently put on the market by MESSRS. A. REYROLLE & CO., of Hebburn-on-Tyne, will be of interest.

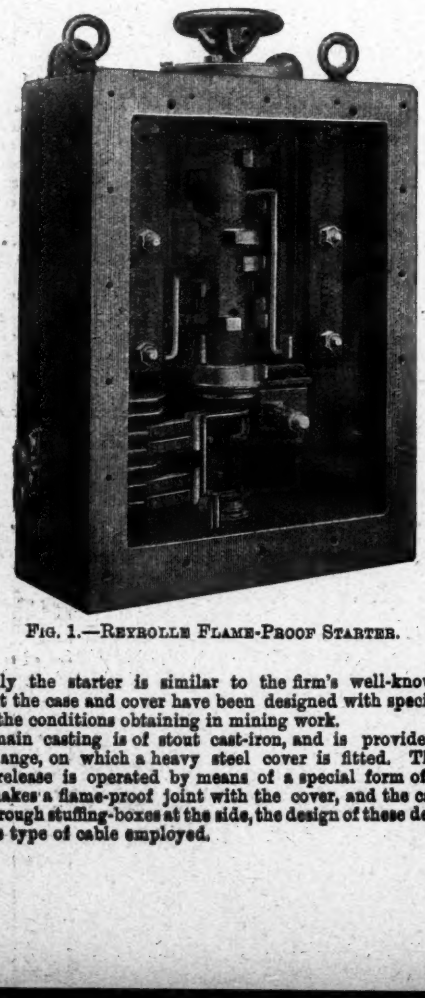


FIG. 1.—REYROLLE FLAME-PROOF STARTER.

Internally the starter is similar to the firm's well-known drum type, but the case and cover have been designed with special reference to the conditions obtaining in mining work.

The main casting is of stout cast-iron, and is provided with a broad flange, on which a heavy steel cover is fitted. The push-button release is operated by means of a special form of plunger which makes a flame-proof joint with the cover, and the cables are taken through stuffing-boxes at the side, the design of these depending upon the type of cable employed.

Messrs. Reyrolle & Co. have satisfied themselves, after an extended series of experiments, that even should a mixture having the maximum explosive force be ignited inside the starter case, there is not the slightest risk of rupture, and further, on account of the long path through which the flame would have to travel, there is no possibility of a flash getting to the outside.

If necessary, these starters can be fitted with overload and no-voltage releases, which are guaranteed absolutely vibration-proof; anyone who has had experience in working coal-cutters will recognise that this is a highly important feature, the vibration on this type of machinery being excessive.

Street Lighting with Tungsten Lamps.

We mentioned recently that MR. HAYDN T. HARRISON, of 11, Victoria Street, S.W., had issued a small booklet on street lighting apparatus, and in view of the rapidly increasing importance of the tungsten lamp in this connection, we have thought it of interest to reproduce one or two illustrations of recent practice.

Fig. 2 shows how, at Harrogate, an arc lamp has been replaced by four high-candle-power tungsten lamps, supported by a graceful branching fitting. Possibly the fitting is rather more ornamental than would seem necessary, but this is a matter which it is essential to consider with due regard to the character of the immediate surroundings of the lamp standard. Fig. 3, by way of contrast, shows an extremely simple fitting for one to four lamps, fitted with Mr. Harrison's D.P. switch-fuse and sealing chamber, as used at Bedford. A very similar fitting is used at Croydon. In some cases

FIG. 2.—FOUR-LIGHT FITTING (HARROGATE).

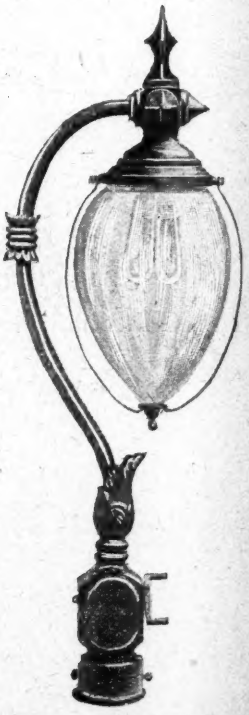


FIG. 3.—TWO-LIGHT FITTING (BEDFORD).

(*e.g.*, Canterbury) the globe is dispensed with entirely, the spigot cap only being provided, to afford the lamp protection from rain. At Marylebone two tungsten lamps have been fitted in each of the existing gas lanterns that have been converted, a convenient fitting for this purpose being available. Mr. Harrison's ingenious D.P. switch-fuse, recently described in this column, is readily fitted to street lamps, as shown in fig. 2, and the Venner time-switch, which switches on and off for 14 days without rewinding, is a useful adjunct. In an appendix to the booklet Mr. Harrison gives useful data regarding street lighting, including the cost of renewals with Osram lamps, for which he is able to undertake supply and maintenance contracts.

"Electra" Insulated Hand-Lamp.

THE ELECTRIC & GENERAL STORES CO., Commercial Chambers, 104, Albion Street, Leeds, are introducing a portable hand-lamp specially constructed to conform with the Home Office regulations, for use in works, collieries, mills, &c. The body of this hand-lamp is made throughout of a substantial insulating material, which, it is stated, will not break, even if dropped upon iron or stone. The

metal parts of the lampholder are so placed that an accidental contact with live parts is impossible. The well-glass screws into

Fig. 4.—"Electra" Portable Hand-Lamp and Parts.

the body of the hand-lamp, and being fitted with a rubber ring, makes a watertight joint with it, while a strong galvanised wire guard is fitted over the well-glass, and is also thoroughly insulated.

Silver-lined Shades and Reflectors.

The Silver-lined Shade & Reflector Co., of 4, Milk Street, Cheapside, E.C., is introducing a series of reflectors of novel type, which give admirable results. The reflectors are silvered on rough cloth, which is attached to card or zinc; they are therefore unbreakable, and

Fig. 5.—Silver-lined Shades.

will not tarnish. They give a soft white light, and having a rough surface, they do not throw bright lines on one's desk. They can be used on any existing fittings. We have used a sample one for some time, and have been much pleased with the pleasant effect and the improved illumination on our work.

BUSINESS NOTES.

Book Notices.—*The Mechanical Design and Construction of Commutators.* By R. Livingstone. London: *Electrician* Printing and Publishing Co. Price 6s. net.—In this little work Mr. Livingstone has applied scientific principles to the mechanical design of commutators, and has produced a book which cannot fail to be both interesting and useful to those engaged in the practical design of dynamo machinery. The author does not concern himself with electrical matters, such as the theory of commutation, contact resistance or determination of electrical losses, but confines himself to the calculation of the mechanical stresses due to centrifugal force, initial tension, and expansion caused by heating, both for commutators of the V-ring and the shrink-ring type. Two practical chapters are given on the building-up of commutators, and various types are described, with criticisms upon their design. A table is given of proposed dimensions of commutators, from 6 in. to 90 in., which may be used as a basis for designers to start from.

A Text-Book of Electrical Engineering. By Dr. A. Thomälen. Translated by G. W. O. Howe. London: E. Arnold. Price 15s. net.—This work is principally intended as a text-book for second and third year students at the Central Technical College, and deals with principles rather than details of practical construction of electrical machinery. The greater part of the book is devoted to generators, motors and transformers. The first two chapters deal with the general laws of electric currents, and with electrolysis, primary cells and accumulators. Subsequent chapters deal with electromagnetic laws and the generation of current, after which the underlying theories of direct and alternating-current generators, motors and transformers are treated in a manner which is exceptionally full and clear. This is essentially a student's book, and can be confidently recommended to those who wish to gain a clear insight into the science of the construction of electrical machinery.

"Leçons sur les Alliages Métalliques." By J. Cavalier. Paris: Vuibert & Nony. 1909.

"Atti della Associazione Elettrotecnica Italiana." Vol. XIII, part 3. May and June, 1909. Milan: The Association. Price L.5.

"Science Abstracts." Sections A and B. Vol. 12, part 7. No. 139. London: E. & F. N. Spon, Ltd. 1909. Price 1s. 6d. each section.

"The Engineering of Ordnance." The Gustave Canet Lecture, delivered by Lieut. A. Trevor Dawson before the Junior Institution of Engineers. London: The Institution.

Chilian Industrial Improvement.—According to an American Consular report, there are strong indications of a general industrial development in Chile far in advance of anything heretofore known in South America. The work of construction on the first steel plant south of Mexico is progressing rapidly at Corral, and it is expected to be ready for operation early in 1910. This plant is to cost $2,000,000 United States gold, and will have a daily capacity of 200 tons. It is backed by French capital, and the machinery, it is said, will be principally of French manufacture. A fine quality of iron ore is found in large quantities within 5 miles of the plant, whence it is to be transported to the works by an overhead cable. A few months ago a large cement plant was opened at Calera, with a capacity about equal to the consumption of the country, and there is a strong movement in favour of Government car works, where all the rolling stock can be manufactured for the State railways. It is expected that the opening of the steel plant early next year will encourage the development of many other industries that are dependent upon the iron and steel industries for raw material. In all of this the Chilian Government is taking an active interest, and wherever possible is lending a helping hand. These industrial developments will open a market for much industrial machinery, and the British manufacturer should keep in close touch with Chilian development for the next few years. Importations of machinery and fuel during 1908 were the only items of importance that showed an increase; the total imports showed a decrease. Machinery enters free of duty.

Catalogues and Lists.—Messrs. W. A. Stevens, Ltd., Victoria Works, Maidstone.—New catalogue of the "Hallford-Stevens" petrol-electric and electric omnibuses and commercial vehicles. One of the petrol-electric omnibuses has been run in London service by Messrs. Thos. Tilling, Ltd., covering 50,000 miles in the past 18 months. The patent electrical equipments are manufactured by Messrs. Stevens, who are sole selling agents in the United Kingdom for Messrs. J. & E. Hall, Ltd., the makers of the vehicles. The catalogue gives specifications and drawings of the omnibuses, &c., and details of the gear, with half-tone views of complete vehicles of various types, and of the "Hallford" engine. Reprint also of an article on the Stevens system of charging the batteries of omnibuses from the mains with efficiency.

Mr. George Ellison, Birmingham.—August calendar card, with portrait of a charming young woman named Harriet, and a view of an A.C. motor-starter.

Mr. E. E. Coy, 77, St. John's Road, Bootle.—Circular describing the "Whipall" electric air pump for inflating tires in motor garages up to 150 lb. pressure per sq. in.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.—Leaflet showing the "Sun" interlocked ironclad D.P. fuse and pressed brass sweating sockets, with particulars and prices.

Visit to Works.—Yesterday the works of Messrs. Mavor and Coulson, Ltd., Glasgow, were open to the members of the joint summer meeting of the Institution of Engineers and Shipbuilders in Scotland and the North-East Coast Institution of Engineers and Shipbuilders, and several interesting novelties were placed on exhibition, including the following: Three-speed 5-H.P. spinner motor in operation, showing the proposed method of speed control for electric ship propulsion; an A.C. motor wound with four and six poles, for use with two separate generators of different periodicities, both generators and both motor windings being used together on the motor at full load and normal speed. For one speed above the normal and one speed below the normal, one generator only is used. This is an alternative method of ship propulsion. Where more than two generators are available, the number of windings on the motor is increased accordingly, and more speeds are available; 10-H.P. single-speed spinner motor, illustrating the use of A.C. motors for starting up against load without the use of resistance or electric control; a Pick-Quick coal-cutter, arranged for working on a steep inclination, as used in collieries in Scotland, in Belgium and in Austria, for dealing with seams not otherwise workable by machine-power; an entirely enclosed dust and explosion-proof motor cooled by air, positively circulated and acting through radiators on the air enclosed in the motor, which is also positively circulated. There was also a stator core in course of construction for a 500-H.P. alternator of normal type, and a number of large motors of the squirrel-cage type for industrial purposes, partly for use on power-supply mains.

New Wiring System.—We recently inspected a new wiring system devised by Mr. Sarsfield W. Martyn, of 11, Pratt Street, Camden Town, which appears to possess many admirable features, and is interesting in view of the importance of the subject of cheap wiring for small houses, which is now so prominently to the fore. Mr. Martyn, whose patent cable connector, watertight fuse, and motor-car terminals have already been described in our columns, contrives by means of a simple universal box to satisfy a remarkably wide range of requirements with the mimimum number of parts and accessories. His system is not yet on the market, but is practically complete. He would be glad to meet with some other enthusiast who would share with him the burden of development of this branch of his business; he already possesses works, offices and the necessary facilities for the commercial management of the undertaking.

Australian Insulators.—A new Melbourne company has been formed for the purpose of manufacturing telegraph and telephone insulators from Victorian clay. A suitable deposit of clay has been found at Ringwood from which insulators can be made.

Liquidations.—Uxbridge and District Electric Supply Company, Ltd.—The creditors and shareholders of this company met on Thursday last week at the Carey Street offices of the Board of Trade, Lincoln's Inn, W.C., when accounts were submitted showing unsecured debts £6,622, loans on debenture bonds £52,579, and preferential claims £89. The assets are valued at £75,038, thus showing a surplus of £15,748 over the liabilities, but the account with the shareholders discloses a deficiency of £10,526. Mr. H. E. Burgess, Official Receiver, reported that the company was promoted in 1900 as the Uxbridge and District Development Syndicate, Ltd., with a nominal capital of £1,000, with the object of providing an electric supply for the parish of Hillingdon. It was found, however, that the expense of obtaining a provisional order would have to be incurred, and the scheme was altered so as to extend the supply to several parishes, including Uxbridge. A provisional order was obtained, and the company was able to start work; a certain amount of capital was subscribed by the public, and the nominal amount was increased, first to £20,000, and eventually to £75,000. The name of the company was then changed to its present title, and its objects were stated to be to carry on at Uxbridge and in the counties of Middlesex, Buckingham and Hereford, the business of an electric supply company in all its branches. A company, known as the General Electric Co. (1900), Ltd., undertook to finance the concern on certain conditions, and had financed it to a certain extent, but later on in the history of the company the directors thought it desirable to transfer the debentures held by the General Electric Co. to the Metropolitan Electric Supply Co., Ltd., who took them up, and at the present time there was £43,000 of debentures held by the latter company. By an agreement dated May 8th, 1905, in consideration of the company withdrawing its opposition to a Bill then being promoted by the Metropolitan Co., the latter undertook to acquire the interest of the General Electric Co. and that of Callender's Cable and Construction Co., Ltd. The sales of electrical energy amounted in 1902 to £721, and had increased to £5,644 in 1908, and after providing for working expenses there was a net profit of £2,903, which went in payment of interest on the debentures. The failure of the company was attributed to want of working capital required to carry out the extension and make it a paying concern. There was a good future still before them, and negotiations were pending with a view to the continuance of the company's business. The liquidation was left in the hands of the Official Receiver.

Geneva Tramways Co. (1906), Ltd.—Creditors are required to communicate with the liquidators, Messrs. A. G. Brand and J. Secar, at 286, Salisbury House, E.C., on or before September 1st next.

Eastern Electrical Syndicate, Ltd.—A meeting will be held at 1, Broad Street Place, E.C., on September 14th, to receive an account of the winding-up from the liquidator, Mr. W. H. Stentiford.

South America.—A syndicate has acquired the rights in the "Z" (Zircone-Wolfram) metal-filament electric lamps for Brazil, Uruguay and the Argentine Republic.

Notices re Patents.—The proprietor of a patent for separating conductors from non-conductors wishes to make arrangements for its working in this country. Notice is given of application for leave to amend a patent for an improved reflector.

The owners of patents relating to vacuum lighting and to an improved system of electric lighting wish to lease their rights.

Particulars are given in our advertisement pages to day.

Private Meeting.—Mountain & Gibson, Ltd., Elton Fold Works, Bury.—The creditors interested in this matter were called together at Manchester, when it was reported by Mr. H. A. Bowden, chartered accountant, that no accurate statement of affairs had been prepared. Taking the balance-sheet of June, 1908, as a basis, the position approximately was that the liabilities amounted to £33,100. The liabilities were as follows:—Unsecured trade creditors, £11,200; unsecured loan creditors, £12,100; and partly secured creditors, £9,800. There were debentures to the extent of £30,000, and after making provision for these, and for preference claims totalling £200, the assets were estimated to produce £29,320. A deficiency was thus disclosed, as regarded the unsecured creditors, of £3,780. The assets consisted of patterns, machinery, buildings, &c., £29,920, and stock, book debts, &c., £29,600. The company was registered in June, 1905, to take over a business previously carried on by a manufacturing company. The nominal capital of the company was £60,000, divided into shares of £10 each. A very large amount of experimental work had to be carried out, and it was found that a large capital was required. At the end of 1907 it was contemplated that new works should be erected. Last year it was decided to remove to Gloucester. Subsequently, it was resolved that a new company should be floated with a larger capital. In May of the present year a prospectus was issued, but the company did not go to allotment. A meeting of the shareholders of the company had already been held, when a resolution was passed for the voluntary liquidation of the company. Mr. H. A. Bowden was then appointed to act as the liquidator in the proceedings. It was pointed out that the meeting was called to comply with the requirements of the Companies' Act, and it was open to the meeting to confirm the appointment of the present liquidator, or to make application to the Court. The matter was discussed at very considerable length, and eventually it was decided that Mr. A. Whittaker, chartered accountant, should be appointed to act as co-liquidator with Mr. Bowden in the voluntary liquidation of the company. A Committee of Inspection was also appointed, consisting of the representatives of the principal creditors.

Brussels Exhibition.—The National Electrical Manufacturers' Association (Inc.) has issued a circular letter to electrical manufacturers regarding the Brussels Exhibition, drawing their attention to the fact that the Board of Trade are giving special facilities to British exhibitors, which briefly consist in fixing the platforms for the stands, show-cases, &c., unpacking and packing the goods, and various other minor matters for the assistance of exhibitors. It is estimated that they will pay £50 out of every £150 expended on British exhibits—in other words, one-third of the expenses. Beyond the assistance which the Board of Trade can give, there are many details (says the circular) in which the Association can be of assistance to those who anticipate exhibiting; among others the following:—

1. It is very desirable that an exhibitor should have some information regarding the positions available for his exhibit beyond that which can be obtained from a plan, and this can only be furnished by someone who has seen the buildings, &c. It is, therefore, suggested that joint action should be taken on the part of the members of the Association who are proposing to exhibit, by arranging for someone to report to them on this point.

2. In the case of firms who would be prepared to make a joint exhibit with others, the Association can arrange for such members to co-operate and obtain an arrangement of space, show-cases, &c., suitable for the exhibit.

3. As regards either the sending out of a representative to report or arranging for joint exhibits, the Association would not make any profit, and would propose to share the actual cost among the exhibitors. It is thought that it will probably be wise for the exhibitors to appoint a representative to go over to Brussels and to act in conjunction with someone who can be appointed locally.

The secretary, Mr. F. B. O. Hawes, invites communications on the matter at the earliest possible moment, so that he can make whatever arrangements are necessary. The exhibition commences in April next, and will remain open for a period of at least six months.

New Zealand Tariffs.—The Customs authorities have recently given a decision to the effect that "electric batteries for use in surgical instruments" are to be classified under No. 190 of the Tariff, the duty being at the rate of 20 per cent. on British goods and 30 per cent. *ad valorem* on those of foreign manufacture.

Platinum Exports from Colombia.—An American Consular report states that the exports of platinum from the Republic were in 1905, 2,475 lb.; in 1906, 565·8 lb.; and in 1907, 20·5 lb.; while the value rose enormously, being $83,088 in 1905, $122,219 in 1906, and $2,856 in 1907.

Trade Announcements.—Messrs. Simplex Conduits, Ltd., inform us that they have been appointed by the British Prometheus Co., Ltd., their sole selling agents in London, the South and West of England and South Wales, and have restocked their various show-rooms with a representative selection of apparatus. The management of this department will be in the hands of Mr. Beves, who has been associated since its inception with the British Prometheus Co.; he will be assisted by Mr. Bennett.

Messrs. Davidson & Blackadder, of 50, Wellington Street, Glasgow, have been appointed agents for the St. Helens Cable and Rubber Co., Ltd., of Warrington, for the whole of Scotland. Mr. J. W. Logan will continue to represent the St. Helens Co. in the Scottish district as a member of Messrs. Davidson & Blackadder's staff.

The partnership hitherto existing between himself and Mr. Schultz and others having termicated by effluxion of time on July 31st, Mr. Charles Comins informs us that he will continue to practise as a chartered accountant at 50, Cannon Street, E.C., on his own account, under the style of Charles Comins & Co.

Messrs. Veritys, Ltd., inform us that their Bristol address is now 59, Victoria Street.

The Bradford Electrical Engineering Co., Ltd., has removed from Royal Arcade to Manningham Lane, Bradford.

The Adnil Electric Co., Ltd., of Adnil Building, Artillery Lane, E.C., has been established under the management of Messrs. R. A. Maiples and S. G. Leach, as the wholesale distributing agency of all types of electrical machinery and apparatus of the well-known "Bergmann" manufacture.

Annual Holidays.—The Lancashire Dynamo and Motor Co., Ltd., Trafford Park.—Works and offices will be closed from August 16th to the 21st inclusive. A small staff will be in attendance to deal with urgent correspondence.

British-Made Gas Engines.—We are very pleased to learn from The Key Engineering Co., Ltd., that they have made arrangements with Messrs. Galloways, Ltd., to manufacture the Ehrhardt & Sehmer gas engines. It will be remembered that in 1907 the company organised a tour on the Continent for the purpose of visiting a number of large gas-engine installations in Germany and France, when Messrs. Ehrhardt & Sehmer's engines were shown driving dynamos, alternators, and blowers, up to a maximum of 2,200 H.P. in one unit; the members of the party were much impressed with the excellent design and substantial construction of these engines, while their performance left no room for criticism. Similar engines have been installed in this country, notably by the Skinningrove Iron Co. (repeat orders), and at an English chemical works (repeat order) where an Ehrhardt and Sehmer 1,200-H.P. engine has been running on producer gas for the last two years. The Key Co. received several propositions from British manufacturers, and gave the preference to Messrs. Galloways, on account of their experience in building large rolling-mill engines, blowing engines, &c.—Messrs. Ehrhardt & Sehmer's speciality. The chairman and some of the directors of Messrs. Galloways, with Mr. Leonard Andrews and Mr. R. B. Slacke, of the Key Co., recently made a tour of inspection on the Continent, and visited several installations, as well as Messrs. Ehrhardt and Sehmer's works, with the result that they were fully satisfied that the large gas engine had arrived at maturity; and after their general manager, Mr. Pilling, had also made a visit of inspection and reported favourably, they decided to enter into the arrangement that we have mentioned. The step will involve a considerable outlay upon tools and equipment, but we have no doubt that Messrs. Galloways will reap a substantial reward, for the reputation of the engine is already established, and even in this country, iron and steel makers are at last awakening to the material economies that may be effected by the generation of power from blast-furnace gas. Moreover, the adoption of gas power in electrical generating stations is quite within the sphere of practical economics, and no one dare say that it is far from realisation. In future the Key Engineering Co. will act as agents both for Messrs. Galloways, Ltd., and for Messrs. Ehrhardt & Sehmer, and we congratulate them upon the successful outcome of their energetic campaign.

Cessio Proceedings.—Robert Richardson, electrical engineer, of Leven (Fife), who was examined in connection with his petition for cessio at Cupar, said he had no assets and his liabilities amounted to £901. His brother was prepared to pay a dividend of 5s. in the £ to his creditors. Debtor, who is in the employment of the Wemyss District Tramway Co., said he got into difficulties when he was in business in Glasgow, and he had to borrow money. Unfortunately he went to moneylenders and tried to clear himself; instead of doing so, however, he got deeper into the mire. The money he received from the moneylenders amounted to about £181; he believed he had paid back £250. The offer of 5s. in the £ was accepted, and cessio was granted. Mr. F. J. Smith, Leven, was appointed trustee.

Reduction of Capital.—Notice is given in the *London Gazette* that a petition has been presented to the High Court of Justice for confirming a resolution of Messrs. Frederick Smith and Co., Wire Manufacturers, Limited and Reduced, reducing their capital from £200,000 to £115,000.

Sale.—Messrs. Percy Huddleston & Co. will offer on Thursday and Friday next the stock and plant of a firm of engineers and electricians at Hammersmith. See our advertisement pages to-day.

LIGHTING and POWER NOTES.

Aberdeen.—The Corporation Electricity Committee has had before it the decision of Mr. W. H. Patchell, London, who was appointed to consider the working arrangements between the Suburban Tramways Co. and the Corporation. Mr. Patchell has suggested a fixed charge of £4 10s. per KW., with an additional ½d. per unit. He has also decided that the Suburban Tramways Co. should pay the Corporation the sum of £900 per annum. By this decision there is a reduction of ¼d. per unit on the old rate, and if the Suburban Co. uses the same number of units in the future as it has done in the past, there will be a saving to the company of about £200 per annum. A five-years' agreement is proposed.

Barking.—The U.D.C. has applied to the L.G.B. for a loan of £2,500 for E.L. purposes, viz.:—Excess expenditure, £745; new plant, £750; transformers, £250; mains extensions, £250; house services, £200; public lighting, £200; meters, £105.

Brazil.—Reporting on the trade of the district of Santos, Mr. Consul Sandell says it may be affirmed that the State of Sao Paula has been the cradle of the utilisation of hydraulic power in Brazil for generating electricity. That at present turned to account, however, is but insignificant in comparison with the immense undeveloped resources which the State possesses in the numerous large waterfalls to a large extent unexplored. The principal hydro-electric installations constructed in the State are that of the Sao Paulo Tramway, Light and Power Co., at Parnahyba, with a capacity of 8,000 H.P., and those of various other companies, viz., at Jundiahy, generating 1,000 KW.; Sorocaba, 1,000 KW.; Rio Claro, 580 KW.; Mococa, 500 KW.; and Piracicaba, 450 KW. The important hydro-electric station in course of construction by the Santos Dock Co. at the Italinga Falls, which should be completed in a year's time, will generate and transmit some 3,000 KW., which will be used in the working of the cranes on the quay at Santos and the supply of light and power to that city.

Bridlington.—The T.C. has applied to the L.G.B. for a loan of £133 for E.L. purposes.

Brighton.—The long-standing controversy between the Tramways and Lighting Committees of the Corporation was temporarily settled at the last meeting of the T.C., held on the 29th ult., when it was decided to reduce the price of traction current during the current financial year from 1·5d. to 1·35d. per unit. The Lighting Committee a short time ago agreed to reduce the price to 1·4d. per unit, but this did not satisfy the Tramways Committee, who asked for it to be reduced to 1·35d. Both Committees took separate reports to the Council, and it was fully anticipated that there would be an interesting discussion, but a compromise was effected before the proceedings came on, so that the price is now, at any rate for 12 months, settled at 1·35d. per unit. Alderman Carden, the ex-chairman of the Lighting Committee, frankly acknowledged that the tramways have been overcharged for several years past, but that the Lighting Committee, owing to the finance not being in a very healthy state, was unable to make any reduction.

Burnley.—The Electricity Committee has decided to alter its practice as regards the payment of the cost of laying service lines; in future all persons requiring a supply of electricity are to be charged the cost of laying cable in excess of 60 ft., and the cost of laying cable on private ground.

Canada.—The Ottawa Electric Co. is pulling down part of its No. 2 power house. When the wheels, timber flumes and penstocks are removed the company will start the remodelling of the station, with a view to adding at least 50 per cent. to the capacity for power development. At some time in the future, when other schemes in contemplation are carried out, this reconstructed power station will be the chief distributing depôt of the company. The project which the electric company is carrying out was rendered possible by the dam built just above the Chaudiere Falls last year by the big milling companies, which added immensely to the volume of water available for power development. The work of constructing the transmission lines for the hydro-electric power scheme is progressing very favourably; the line is being built both ways—towards Dundas and towards the Niagara Falls.

Montreal.—The Dominion Light, Heat and Power Co. is putting down a plant which will consist of three 250-H.P. twin cylinder Hornsby-Stockport gas engine units and two 125-H.P. units, coupled to three-phase 60-cycle alternators. Under the contract this plant will be in operation by December next; it is being supplied by the Colonial Engineering Co., which has already made some 14 very successful installations in Canada.

Continental Note.—Holland.—A project is on foot to construct a central generating station for the purpose of supplying with electric light and power the east district of North Brabant as far as Bois-le-Duc and the centre of Limbourg, including Luremonde, Venloo and Weert.—*Board of Trade Journal.*

Dukinfield.—At the meeting of the Town Council on Monday, Alderman W. Wood stated that the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board had produced electric current at a cheaper rate than any other undertaking in the kingdom, and he explained that the policy of the Board in charging 1d. to the tramways and less than ½d. per unit to private firms had resulted in a reduction of the loss of £5,000 in 1907 to £500 last year.

Epsom.—The inquiry into the application of the U.D.C. to borrow £1,500 for the purpose of electric lighting was resumed last week, when the Inspector (Mr. Hooper) explained that what he wanted to know was what steps had been taken to improve the condition of affairs which existed in December last. The clerk to the Council, and the accountant, stated that they were unable to give the net loss for the year ending March 31st, 1909. Mr. Foster, the former engineer, was sent for, but replied that he was unable to attend owing to an important engagement. The Inspector pointed out that there had been a loss of £7,122 on the undertaking, and they had been going on from year to year with a steady loss of £900 per annum. In the course of further discussion, the Inspector said that it appeared that the undertaking had been too ambitious altogether at first, and that the Council had been carrying on a system of lighting and did not even know what it cost. There had been a loss on both the public and private lighting, and the position in regard to the former was that the price charged had never been worked out. Evidence having been given, the inquiry was concluded, but the Inspector said that, in his opinion, the Council should have arranged for Mr. Foster to be present.

Finchley.—Some interesting correspondence has taken place between the Assistant Secretary, L.G.B., and the Council, relative to the loan of £2,200 for arc lighting. The L.G.B.'s letter hinged on an inquiry held by its Inspector, Mr. Hooper, with reference to sanction to the loan for arc lighting in Bollards Lane, Regent's Park Road, and Great North Road. The Board suggested that the Council should carefully consider the cost of gas lighting, and asked for reports of comparative costs of electric and gas lighting. The Council's reply was a lengthy one, detailing matters in connection with the lighting, and concluded with the following pertinent paragraph:—"They (the Council) respectfully submit that the point which the Board is called upon to decide is whether a loan should be granted for the necessary sum to enable arc lighting to be installed, and not as to whether gas or electricity should be used."

Gloucester.—The T.C. has decided to apply for a prov. order for E.L. in the area of the R.D.C.

Horsham.—At last week's meeting of the U.D.C. it was reported that the electric lighting accounts up till the end of March last, show a balance in hand of £10 after paying instalment of loans, working expenses, &c. Last year there was a deficit of £147. This is the first year an actual profit has been shown. The income for the year was £4,228, and the expenditure £2,187, leaving a gross profit of £2,041. Interest and instalments of loans came to £2,031.

Hull.—The Corporation last week discussed the negotiations with the Hessle Council with respect to the prov. order for electric light. It was pointed out that the Hessle Road was being rapidly built up towards Hessle, and that the D.C. had been urging the extension of the tramways also into Hessle, so that it seemed likely that before long Hessle would be taken into Hull. The Committee decided to make an offer to the D.C. of £200 for taking over the prov. order.

Ilford.—For the year ending March 31st the income of the electricity undertaking was £28,721, leaving a gross balance of £10,678, or £1,000 more than in the previous year. After deducting payment of interest and instalments of loan, there was a surplus of £1 1s. 11d., as against a loss of £375 last year. The reserve fund stood at £6,398, which was no increase on the previous year nor, indeed, on 1907. Three million units were sold during the 12 months, and there are now over 3,000 consumers on the books. Mr. Philpot, chairman of Electricity Committee, stated at the last meeting of the Council that the policy in the past years was to supply consumers at the lowest possible rate, but he did not think they had reached the minimum price yet. When they, however, got their price down to the minimum, the surplus would be devoted to the relief of the rates. In reply to questions, Mr. Philpot said he had hoped they might have been able to make a further reduction in the cost of power, but he did not think the prospects of doing so immediately were particularly rosy.

Kingston-on-Thames.—The T.C. has decided to install an electrically-driven 10-in. centrifugal pump at the sewage works.

Limerick.—On Monday, last week, a brief strike occurred at the electric lighting works, the men apparently going out in sympathy with the local gas workers, who struck owing to dissatisfaction at the employment of a particular man.

Little Lever.—The Lancashire Electric Power Co. has written to the Little Lever District Council asking for permission to supply electricity to several local premises by means of overhead wires. The matter is held over.

Longton.—The T.C. has decided to extend the mains to the Florence and Dresden districts at an estimated cost of £1,550, and a loan of £1,250 for this purpose has been applied for.

London.—The annual report of the City engineer, Mr. Frank Sumner, which has just been issued, says the lighting of most of the main thoroughfares by arc lamps was continued throughout the year. The number of the original type "open" electric lamps in lighting at the end of the year, at a cost of £26 each, was 398, being a decrease of two, accounted for by the substitution of the new and cheaper flame arc on the new rest in Aldersgate Street, and the abandonment of one lamp on the Blackfriars Bridge Approach, by the Royal Hotel, the latter being no longer required. In addition to this number, there were 34 "Oliver" flame arcs (mostly experimental), and 18 "Reason" enclosed arcs (experimental) in lighting during the year. These lamps were lighted on 23 days during the year when fog or unusual darkness occurred, at a total additional cost of £147. The number of defective electric lamps reported during the year was 71. The returns of these defects are made daily by the Police, and the City of London Electric Lighting Co. were fined for each failure, the amount deducted from their account during the year being £16. The number of arc lamps in lighting on December 31st was as follows:—398 original type "open" lamps, price per annum, £26, City of London Electric Lighting Co.; 23 "Oliver" flame arcs (partly experimental), £17 10s., City of London Electric Lighting Co.; 18 "Reason" enclosed arcs (experimental), Farringdon Street, price per annum, £12 10s., City of London Electric Lighting Co.; 11 "Oliver" flame arcs (experimental), Cannon Street, price per annum, £17 10s., Charing Cross Co. The four flame arcs at Blackfriars Bridge Approach and the four at the Mansion House area, put up by the City of London Co. for its own experiment, are charged at £26 each per annum during the year. With regard to overhead wires, Mr. Sumner says that since 1899, when the Corporation took in hand the work of supervision, a total of 25 miles of derelict wires have been removed. During the past 12 months five of such wires had been removed of a total length of 276 yards, together with their insulators and attachments. In addition, where identification was possible, a large number of disused wires and attachments were taken down by the companies and owners; the total length removed in this way during the 12 months being 4 miles 358 yards, the result of 184 notifications. All owners of overhead wires are required to identify same by having a perforated zinc label of approved pattern attached to each fixing. The numbers or identification marks are registered and the system has proved a great advantage. One of the results of inspection on the roofs is that large numbers of wires have been found to have been erected in the City without any notice at all having been given, and it is only due to careful supervision that new lines are detected. During the year the number of private owners of lines was 137 and the number of companies increased to 23. Both have considerably added to their number of spans during the last 12 months, and these now total 733,828 crossing public thoroughfares, as compared with 733,200 last year and 260,000 in 1899. There has been a net increase of 755¾ miles of National Telephone Co.'s wires, while other companies and other owners have added about 22 miles to their lines. The tendency of the National Telephone Co. is to take down their "open" wires and small cables and substitute for them heavy cables; the larger and more recent contain as many as 400 wires, the number of wires thus increasing in a greater ratio than the spans. The number of defects notified in 1908 was 5,602, as against 2,795 in the preceding year, and 1,854 in 1906. Owing to the acids formed in the smoky City atmosphere, the corrosion of exposed metal proceeds far more rapidly than is generally supposed, and the galvanising applied as a protection to pole stays and cables suspending wires does not last long. The City of London Electric Lighting Co., Ltd., gave notices during the year for laying 232 services, and the construction of 20 new boxes in connection with the supply of electrical energy to premises, and the Charing Cross Co. gave 98 notices for laying services and 51 to repair boxes.

London.—ST. PANCRAS.—The gross income of the electricity undertaking for the year ended March 31st last was £75,358, a decrease of £2 243 as compared with the previous year, and an increase of £1,187 in comparison with two years ago. The net profit was £6,925, as compared with £9,454 in 1908 and £6,495 in 1907. It is pointed out, however, that the latter year bore the cost of a legal action which amounted to £3,585. There is to the credit of the reserve fund £38,773. The Electricity Committee recommended that £4,000 of this year's surplus be allocated to the relief of the lighting fund, and that the remainder be placed to the credit of the reserve fund. The Finance Committee, however, considered that no definite sum should be allocated to the relief of the lighting rate, and that the matter should be held over until the Council's requirements for the ensuing half-year are known.

ISLINGTON.—A Special Committee has decided that the charge for public arc lighting should by reduced by £3,000 per annum, which would, upon the basis of last year's consumption, be equivalent to 2·10d. per unit, and which would bring the total charge to £12,734 per annum. After a discussion the B.C. resolved to fix the figure at £12,100 per annum.

Luton.—The T.C. has authorised mains extensions in Hibbert Street, Langley Road and Union Street at a cost of £264. A number of straw hat manufacturers in this district intend using electricity for power purposes.

Mexico.—A concession has been granted to Mr. M. Parry Gosset to utilise the waters of the River Elota, in the States of Sinaloa and Durango, for the generation of electrical energy. The contract is for a term of 20 years, and the works involved must be completed in seven years.

Middlesbrough. — The T.C. has received from the L.G.B sanction to a loan of £18,922 for mains, house services and public lighting.

Peterborough.—The accounts of the Corporation electricity undertaking for the past year show a surplus of £3,917: and after provision has been made for interest and sinking fund, a surplus of £89 remains.

Smallthorne.—The U.D.C. has asked Hanley T.C. if it can supply energy for public and private lighting. The Hanley Committee points out that it is not at present in a position to say upon what terms a supply can be given, and the matter has been deferred pending the receipt of further information from the British Aluminium Co., Ltd., who propose to establish works in the district.

Sunderland.—The Electricity Committee of the T.C. has recommended that the charge for electricity for the tramways be reduced from 1¼d. per unit to 1½d. This will reduce the bill for power by £1,380 per annum.

Surrey.—At the meeting of the Metropolitan Asylums Board, last week, it was reported that the South Metropolitan Co. had agreed to the installation of auto-transformers and metallic lamps in the Children's Infirmary at Carshalton and the Downs School at Sutton, under an agreement which will extend to December 31st, 1918, and in which the company undertakes not to raise the price of current for lighting purposes above 2½d. per unit. It further agrees that the supply of current for the charging of electric vehicles shall be 1½d. per unit, instead of 2½d.

Todmorden.—The T.C. has resolved to duplicate the large gas engine and generator at the electricity works, and the manager is to obtain the necessary tenders for the work. An application for a supply of energy to the Joint Stock Mill was favourably considered.

Trowbridge.—The Western Electric Distributing Co. has informed the U.D.C. that it intends applying for a prov. order for E.L. A previous order granted to the Council has been cancelled.

Tunbridge Wells.—The Borough Education Committee has requested the borough electrical engineer to furnish to the town clerk a report he has prepared on the subject of school lighting, which deals with the advantages of the electric light over other illuminants. A copy of the report is to be sent to each member.

Tyldesley.—The U.D.C. has decided to accept £480 as consideration money on the completion of the transfer of the electric lighting order to the Lancashire Electric Power Co.

Walton-on-Thames.—The U.D.C. has asked the Urban Electric Supply Co. to submit a tender for public lighting.

Worthing.—The resident engineer having reported that the nine Beck flame arc lamps obtained in April last for trial have been found to be very satisfactory, the Electricity Committee has decided to recommend the removal of the existing arc lamps in favour of the Beck flame lamps when and as expedient.

TRAMWAY and RAILWAY NOTES.

Brazil.—The firm of Griffiths & Co., of London, is stated to have sent in a proposal to the Minister of Public Works for the electrification of the suburban lines of the Central of Brazil Railway to the station of Deodoro and for the construction of the new central station in the city. The period asked for the completion of the work is 15 months, whilst the company suggests that payment should be made by means of a special issue of gold polices bearing 5 per cent. per annum, amortisable in 20 years. Presumably there will be a call for tenders for the execution of the work and this proposal will be presented together with others of a similar nature. Since the above was written, the President of the Republic has sent a message to Congress dealing with this matter. It is stated that the whole work will cost $5,000,000, and that there will be a reduction of at least $1,000,000 per annum in running expenses as a result of the electrification, in view of which fares and goods tariffs will be reduced. At present the Government does not intend to proceed with the question of building a new central station. The electrification will at first be undertaken as far as D. Clara, whilst a third line will be laid as far as that station. Subways and bridges are to take the place of level crossings. The time taken to D. Clara will be 30 minutes when the electrification is completed, and no stops will exceed 22 seconds.—*Brazilian Review.*

Bury.—The through-running of cars between Rochdale and Bury commenced on the 1st inst., there being a 20-minute service. Arrangements have been made as to the working agreement, the expenses being estimated on last year's accounts, and subject to readjustment at the end of the financial year. Forty-five minutes is allowed for the through journey. The usual intermediate service between Rochdale, Sudden and Heywood will be continued, the cars running *via* Manchester Road.

Cheshire.—The proposed scheme for the construction of an electrical railway in the Wirral Peninsula, announced in the Electrical Review some months ago, when the plans of Messrs. Pearce and Lloyd, of Liverpool, architects of the Development Co., were submitted, is to be enlarged, we are informed, by the connecting of Port Sunlight with Thornton Hough and Heswall by means of an electric railway, while a system of tramways will intersect West Cheshire. The tramways, it is intended, will feed the railways, and the electric power produced will be turned to account in several new works that are to be opened in view of the scheme.

Continental Notes.—Austria.—It is announced that detailed schemes are being prepared for the conversion to electric traction of a number of those particular sections of the Austrian State Railways, which appear to be the most suitable from a technical and economic point of view in consequence of the heavy gradients, the existence of tunnels, the vicinity of available water-powers and the density of traffic. The sections include those between Innsbruck and Lindau, Feldkirch, Buchs and Bregenz St. Margarethen, St. Veit a.d. Glan-Assling-Trieste, and a number of others. The total length is 607 miles, and this comprises about one-fourth of all the lines in districts where water-power is likely to be utilised for electrical generation.

Spain.—The British Consul-General at Barcelona reports that very little has been done during the past year towards the extension of tramway lines in the city and suburbs, the three companies—two Belgian and one German—owning the entire system paying their attention to the improvement of the permanent way and of the rolling stock. Many new and commodious cars have been put on the lines, all of them made abroad, shipped in parts to the port, and put together in the local tramway workshop. There have been several concessions applied for regarding small extensions of the German lines, and one of considerable importance was granted to a Spanish company for a line from Barcelona, crossing the neighbouring hills to the north of the city, and continuing through the valley beyond as far as the towns of Rubi and Sabadell, a total distance of some 15 miles; but up to the present the promoters have not been able to secure sufficient capital. A Belgian syndicate, which some years ago bought up the British company controlling what may be termed the metropolitan lines, has now amalgamated with the company which works the suburban lines to Sarria and Sans, the combined capital being about £1,000,000. It will be recollected that during the recent rising in the city the tramways were held up by the revolutionists, many of the cars being utilised to build barricades in the streets.

Edinburgh.—An inquiry under the Private Legislature Procedure (Scotland) Bill into the Colinton Tramways Order has been held in Edinburgh. Powers are sought to link up the cable routes of the city with Colinton by an electric tramway; these were opposed by the City and Midlothian C.C., but the preamble was found proved.

East Ham.—Sanction has been received from the Board of Trade to borrow £1,836 for tramway purposes. A portion of the work covered by this sanction is the relaying of the track in High Street North. The engineer and manager reported to the Tramways Committee that he had considered means to do away with the hammering at the joints on the tramway rails, which is now making itself apparent on the tramway system, owing to wear and tear. He found that good results had been obtained elsewhere from the use of manganese steel plates over the joints, which was the patent of the Patent Railway and General Engineering Co., of Nottingham. The company would fix these plates at a cost of 35s. for each joint, inclusive of unskilled labour, excavating and making good afterwards. The Committee has decided to give the plates a trial, and 100 joints, at 35s. per joint, are to be treated in the manner mentioned.

Liverpool-Southport Railway.—The Lancashire and Yorkshire Railway Co. has been carrying out experiments on the electric line between Liverpool and Southport, and has now devised a new car for this service by which it hopes to reduce to the minimum the possible firing of coaches by short circuits. A train fitted with the new apparatus has been designed, and a trial trip was made last week between Liverpool and Southport, when the members of the Institution of Mechanical Engineers taking part in the summer conference made the journey as guests of the Lancashire & Yorkshire Railway Co. It is claimed by the company's engineers that the new system will mean the "deadening" of the line between the train and the source of supply of electric current. At the time of the fire on this line some months ago, it was contended by passengers and others that there was too much timber about the coaches, and taking this into consideration, the new design has provided that the driver's cab shall be of metal, and all the gear for the control of the motors is placed inside this compartment. Fire extinguishers are placed at the entrance to the first-class and at the end of the third-class coaches.

London.—The Oval station of the City and South London Tube was the scene of a slight lift accident on Monday evening. Through the breaking of a water pipe, the lift (a hydraulic one) suddenly dropped a short distance to the bottom, some of the passengers being cut by broken glass and others getting a wetting from the escaping water.

The last Saturday in July saw the opening to traffic of the Norbury extension of the Streatham route and the Hackney-Bloomsbury section of the L.C.C. tramways.

G.N. & City Railway.—An interesting article appears in the *Financial News* of Wednesday, which touches on the presumably close connection between the Gt. Northern and City tube line and the Gt. Northern Railway—which company, it is hinted, may have made good the deficiency in the Tube Co.'s earnings, mentioned in the report this week. The G.N. Co. has already considerable financial interest in the tube line, and owns the 64 chains of tube connecting Drayton Park and Finsbury Park. Moreover, the G.N. Co. is known to desire better access to the City than it at present obtains at Moorgate Street or elsewhere, it also has credit to obtain the funds necessary to extend the tube line as originally proposed to Lothbury. The Gt. Northern Co.'s sidings connect with the Drayton Park tube station, and a few weeks ago one of the company's locomotives drew a five-coach tube train—which had been suitably modified—from the latter station to High Barnet and back, with a view to testing its behaviour on the track, &c. Further, the G.N. Co.'s surveyors have been engaged in survey work which suggests the intention of constructing a short direct line between the siding and tube line. Our contemporary concludes: "These events seem to entitle us to look before long for important developments in relation to the Gt. Northern and City Railway."

Peterborough. — Sir A. Kennedy, the arbitrator appointed by the B. of T. to settle the price to be paid by the Peterborough Electric Traction Co. to the T.C. for electrical energy, has made his award. Sir A. Kennedy has fixed the price for five years from September 1st, 1907, at 2d. per unit for the first 120,000 units in each year, and 1½d. per unit for all energy beyond that quantity in each year. The arbitrator directs that the cost of the arbitration shall be paid by the Town Council, except the costs of three Peterborough witnesses called by the company.

Salford.—The annual report of the Salford Corporation Tramways shows that there was a decrease in the gross receipts amounting to £1,553 14s. The average receipts per car-mile were much less than the figure for the preceding 12 months. The reduction in receipts per car-mile amounted to ·60d., and represented a loss in earnings of approximately £14,463 13s. 5d. compared with the previous year. The net profits this year were only £17,263 17s. against £28,206 7s. 4d. The number of passengers carried was 45,975,584, an increase of 203,973; miles run 5,785,469, increase 299,319; average receipts per car-mile 9·84d. against 10·44d. The total length of tramways worked by the Corporation up to March 31st last was 75 miles; total electrical energy used for haulage, lighting of cars, &c., 9,258,774 units, an average consumption of 1·62 units per car-mile run. Salford has now 200 cars. Of the 40,271,518 tickets sold during the 12 months, 28,233,040 were of the value of a penny. Scholars' tickets sold were 97,547 of the value of a penny each. In addition 2,988,918 workmen's tickets were issued.

Tramway Competition.—At both the meetings of the Great Eastern and of the South-Eastern and Chatham Railways held last week, reference was made by the respective chairmen to the effects of tramway competition. In the case of the former

line, it was announced that the decrease for 1909 below 1908 was only £409, as compared with a decrease of £4,390 in 1908 below 1907 (these figures presumably refer to London suburban traffic). Reductions in fares and increased facilities were being given to induce residential traffic from points beyond the zone of the tramways. The South-Eastern chairman said that to compete with the tramways would mean a very large capital outlay, and all the evidence showed that a proper and fair return on the outlay could not be obtained. The tramways depreciated the surrounding property and drove people further out, and for this outside traffic the managing committee were catering.

As a contrast to the above may be cited the reference in the Brighton meeting to the completion of the South London electrified route, which, by all accounts, should be running in a few days.

TELEGRAPH and TELEPHONE NOTES.

Belgium.—In 1907 the system of aerial, subterranean, river and submarine telegraph lines increased by 278 km., of which 277 were aerial, to 6,991 km.; while the length of wires increased by 580 km., to 38,226 km. The number of offices was increased by 80, to 2,418, which were worked by 4,162 employés of all grades—an increase of 298 over the previous year; other employés numbered 5,390. Inland traffic numbered 3,641,229 messages, an increase of 19,097; international traffic consisted of 3,345,090 telegrams, an increase of 12,720; while transit telegrams numbered 537,614, an increase of 13,534, making the total number of messages handled 7,523,933, or an increase on the previous year of 45,351. International telegrams produced a revenue of 2,704,096 fr. Service telegrams numbered 12,615,700, an increase of 888,435. Inland traffic produced 2,090,431 fr., and, together with 308,318 fr. obtained from transit telegrams, the total revenue amounted to 5,684,310 fr., which also includes revenue from other sources. Expenses amounted to 8,758,805 fr. The capital account amounted to 64,566,947 fr.

The mileage of telephone wire increased by 18,767 km. to 173,244 km., and the exchanges from 182 to 196, while the subscribers numbered 28,946, an increase of 2,875 over 1906. International conversations produced 633,850 fr., and the revenue totalled 8,457,318 fr., or an increase of 715,302 fr. The combined revenues of the telegraph and telephone services exceeded combined expenses by 5,382,824 fr.—*Journal Télégraphique.*

New Cables.—The *Elektrotechnische Zeitschrift* states that the laying of the Emden-Teneriffe cable will soon be commenced, and that the Spanish Government is about to lay cables between Barcelona and Genes, and Carthagena and Oran.

Telegraphic Interruptions:—

Tangier-Cadiz	May 19, 1909
Assab-Perim	July 8, 1909

Wireless Telegraphy.—The wireless station at Trois Amis, San Fernando, Trinidad, has been completed, and it is said that trial messages have passed between it and the colony of British Guiana.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Ten 100-number switchboards for the Postmaster-General's department in New South Wales. See "Official Notices" July 16th.

New South Wales.—Telephone material for the P.M.G. See "Official Notices" July 23rd.

Ballinasloe.—September 10th. The Committee of Management of the Ballinasloe District Lunatic Asylum wants tenders for the supply and erection of overhead cables. See "Official Notices" July 30th.

Belgium.—The municipal authorities of Ramet-Yvoz (Province of Liége) are inviting tenders until the 9th inst., for the concession for the public and private electric lighting of the town.

Cleckheaton.—The U.D.C. wants tenders for the purchase of two battery regulating switches. See "Official Notices" July 30th.

Edinburgh.—September 4th. The Corporation invites tenders for a motor-alternator and for an electric lighting installation. See "Official Notices" to-day.

France.—Paris.—August 18th. The Under-Secretary for Posts and Telegraphs, 103, Rue de Grenelle, Paris, requires tenders for 75 stamping machines worked by electric motors.

August 11th.—The Direction de la Manufacture d'Armes at Châtellerault (Vienne) requires tenders for cables, copper wire, and dynamo construction material (11 lots).

Germany.—Cologne.—August 25th. The Stadtisches Maschinenbauamt, Cologne, is inviting tenders until August 25th for the supply of four electrically-operated cranes.

Italy.—August 10th. The Italian State Railway authorities in Rome are inviting tenders from foreign as well as from home makers for the supply of 100,000 metres of telegraph cable.

August 18th.—The Italian State Railway authorities in Rome are inviting tenders for the supply of six electrically-operated drop hammers.

Keighley.—August 7th. Two 1,000-kw. turbo-alternators with condensers, and two water-tube boilers for the electricity department. See "Official Notices" July 16th.

Leyton.—Tenders, to be considered early in September, are to be invited for 100 public lighting lanterns with clock switches to complete the conversion of gas lamps in the district, also for wiring the extension of the public offices, now being erected.

London.—G.P.O.—August 9th. Creosoting telegraph poles for the P.M.G. Mr. G. Morgan, Controller of Stores, 17-19, Bedford Street, W.C.

Battersea.—August 21st. The Council wants tenders for motors and controllers, d.c. flame and enclosed arc lamps, and motor and arc lamp installations. See "Official Notices" to-day.

L.C.C.—September 14th. The L.C.C. wants tenders for the supply and laying of 6½ miles of 0·075 sq. in. three-core cable and 46 miles of single-core cable, telephone cables, &c.; the supply of 50 tramway feeder pillars; laying 16 miles of stoneware ducts; and the supply of 440,000 stoneware ducts. See "Official Notices" to-day.

Rhyl.—August 21st. The U.D.C. invites tenders for a 125-kw. Diesel set and a 50-kw. steam dynamo. See "Official Notices" to-day.

Russia.—September 13th. The municipal authorities of Bachmouth (Government of Ekaterinoslav) are inviting tenders for the concession for the public electric lighting of the town.

Salford.—August 9th. The Corporation wants tenders for the purchase of a steam dynamo of 120 kw. See "Official Notices" July 30th.

Spain.—August 26th. Sixty years' electric tramway concession (between Monachil and the suburbs of Gabia Grande, Granada province). Tenders, with £130 deposit, to Direccion General de Obras Publicas, Madrid.

August 27th.—Tenders are invited by the Direccion General de Obras Publicas, at Madrid, for the taking-over of a concession for the building and working of a system of electric tramways in Barcelona. A deposit of 40,596 pesetas must accompany the tender.

Todmorden.—August 14th. The Corporation wants tenders for a 150-kw. steam dynamo, switchboard, condensers and piping, and pump. See "Official Notices" to-day.

Turkey.—The Ministry of Marine, in Constantinople, invites tenders for the supply of electrical apparatus for the Imperial fleet. Inquiries should be addressed to the Conseil de la Marine, Constantinople.—*B. of T. Journal.*

York.—August 27th. The Corporation wants tenders for 18 double-deck electric tramcars and a watering car. See "Official Notices" July 30th.

CLOSED.

Belgium.—Six concerns submitted tenders for the establishment of a central electric lighting station in the little town of Hollogne-aux-Pierres (Province of Liége), the lowest being that of the Société Electricité et Mecanique, of Charleroi.

Bradford.—The Board of Guardians has accepted the tender of the Easton Lift Co., Ltd., for the supply of brakes on two electric lifts, for the sum of £32 12s.

Canada.—The Colonial Engineering Co., Ltd., Montreal, has closed a contract with the Dominion Light, Heat and Power Co. for a 1,000-h.p. Hornsby-Stockport gas-engine equipment, to be installed in the City of Montreal for the purpose of public and private electric supply.

China.—According to *Commercial Intelligence*, the Eastern Trading Co., Ltd., has been selected out of 26 tenderers to erect modern electric lighting plant for the city of Nanking. Plant is to be supplied by Messrs. Babcock & Wilcox and Messrs. Belliss and Morcom.

Eastbourne.—The T.C. has accepted the tender of Messrs. Lassen & Hjort, at £155, for water-softening plant. The engineer's estimate was £200.

Eccles.—The T.C. has accepted the tender of Messrs. Waring & Gillow, Ltd., of Manchester, for installing the electric light in the Corporation Road houses, at £48 15s.

France.—The French Post and Telegraph authorities have just given out contracts as follows:—La Compagnie Générale d'Electricité, of Paris, 60 tons of bronze wire, $1\frac{1}{10}$ mm. diameter, at 2,820 francs per ton; 100 tons high conductivity copper wire, $2\frac{1}{2}$ mm. diameter, at 2,090 francs per ton; and 100 tons ditto, at 2,092½ francs per ton. M. Grammont, of Pont du Cherny (Isère), 60 tons of bronze wire, at 2,800 francs per ton; 60 tons of copper wire, 2 mm. diameter, at 2,097½ francs per ton; and 100 tons ditto, $2\frac{1}{2}$ mm. diameter, at 2,065 francs per ton. La Société des Tréfileries du Havre, 100 tons of bronze wire, at 2,825 francs per ton, and 600 tons of copper wire, at 2,090 francs per ton. La Compagnie Française des Métaux, of Paris, 200 tons of copper wire, at 2,080 francs per ton. La Société d'Electro-Métallurgique de Dives, 100 tons of copper wire, 3 mm. diameter, at 2,060 francs per ton; and 50 tons of annealed copper wire, at 2,090 francs per ton. La Société des Mines et Fonderies de Pontgibaud, 100 tons of copper wire, 3 mm. diameter, at 2,055 francs per ton. La Société des Forges de Franche-Comte, of Besançon, 100 tons ditto, at 2,050 francs per ton; and La Compagnie Française du Bi-Métal, of Paris, 100 tons of copper wire, 4 mm. diameter, at 2,040 francs per ton.

Glasgow.—The Tramway Committee on Works has recommended the acceptance of the following tenders:—Special track work, the Lorain Steel Co.; teak flitches, Brownlee & Co., Ltd.; scrubber blocks for rail grinder, Chas. Churchill & Co., Ltd.; speed indicators for rotary, Union Electric Co., Ltd.; copper rail bonds, the Lahmeyer Electrical Co., Ltd.; telephone cable, British Insulated & Helsby Cable Co.

Grimsby.—The T.C. has accepted the tender of Messrs. John Wilson & Co. for additional pipe-work in connection with the superheaters, at £21 10s.

Hanley.—The T.C. has accepted the offer of the Chloride Electrical Co. to maintain a secondary battery in full efficiency for ten years, at £5 per annum.

Ilford.—The U.D.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for four tramway cars, at £561 each.

Japan.—In connection with the electric railway which is now being built between Osaka and Kyoto, the contract for the power station steam generating plant (according to the *Indian Textile Journal*) has been secured by Messrs. Babcock & Wilcox, Ltd. The boilers, which are six in number, are specially constructed to the specifications of the Kei-han Deski Tetsudo Kabushiki Kwaisha.

Leyton.—The U.D.C. has accepted the tender of Messrs. Johnson & Phillips, Ltd., for the electric light installation at Sybourn Street Schools, at £172 6s. 8d.

London.—ST. PANCRAS.—The B.C. has received the following tenders for the annual supply of arc lamp carbons:—

William Geipel & Co.		£362 3 4
Sloan Electrical Co., Ltd.	(accepted)	382 1 8
H. G. Mayer & Co.		420 0 0
Crompton & Co., Ltd.		424 8 4
G. Baulik		452 5 0
Andrew & Suter		467 0 0
General Electric Co., Ltd.		498 0 0
Sirius-Werke (M. Seeck)		513 6 8
Ship Carbons, Ltd.		516 5 0
Siemens Bros. Dynamo Works, Ltd.		672 5 0
Piggott Electrical Co. (Smith Bros.)		758 0 0

Longton.—The T.C. has accepted the tender of the Electric Construction Co., Ltd., for engines and dynamos.

Luton.—The T.C. has accepted the tender of Messrs. W. H. Allen, Son & Co., Ltd., of Bedford, for a 500-KW. steam engine and dynamo, at £2,370; and that of the Brush Electrical Engineering Co., Ltd., for condensing plant, at £780 10s.

Maidstone.—The T.C. received the following tenders for feeder cable:—

Union Electric Co.		£317 11 0
Western Electric Co.	(accepted)	397 0 0
Callender's Cable and Construction Co.		408 18 2
Henley's, Ltd.		412 0 0
Johnson & Phillips, Ltd.		412 0 0
B.I. & H. Cables, Ltd.		412 10 6
W. T. Glover & Co., Ltd.		414 17 0
Electrical Co.		424 10 9

Salford.—The Council has accepted the tender of Messrs. Harland, Bowden & Co., at £765, for re-wiring at the Royal Technical Institute.

South Africa.—CAPE TOWN.—The Corporation has accepted the tender of Messrs. Pooley & Austen, of London, for the supply of 110 street-lamp fittings, at 16s. each f.o.b. The c.i.f. amount of this tender is £98 13s. 3d., while the delivery and other charges are estimated not to exceed £10, making a total of about £109.

West Bromwich.—The T.C. has accepted the tender of the Aron Electricity Meter Co., Ltd., for the repair of Aron meters for a year.

West Ham.—The Corporation received 12 tenders for the supply of six new tramcars, and accepted the following:—United Electric Car Co., Ltd., car bodies, £1,932; Brush Electrical Engineering Co., Ltd., electrical equipment, £1,161. An order has been placed with Mr. E. Peckham and the Anti-Magnolia Co., at £150, for the purchase of two trucks for the tramway undertaking and the purchase of the material for five others, these to be constructed at the car-sheds on payment of a royalty of £10 per truck to Mr. Peckham. The estimated cost of the seven trucks is £550.

NOTES.

Electrical Fatality.—On Saturday afternoon Edward M'Bride, aged 10 years, who resided with his parents at 10, Field Street, Birkenhead, met with his death on the Mersey Railway. He was playing with his companions when he strayed on to the line, and, coming into contact with the live rail, received a shock, which resulted in practically instant death.

Mining Explosion.—Some interesting revelations as to the manner in which electric apparatus is misused in some coal mines were made at a public inquiry held in Hamilton the other day. The inquiry was into the circumstances of an explosion which took place at Ferniegair colliery on June 27th last, when one man was killed, and two others so injured that they succumbed to their injuries three days later, in the Royal Infirmary, Glasgow. At the time of the explosion the deceased workmen were getting in readiness for the week's work an electrically-driven coal-cutting machine, and the inquiry chiefly centred upon what had caused the explosion. Mr. Nelson, of the Home Office, in giving evidence regarding a visit he had paid to the pit on July 1st, stated that he had previously learned that one of the deceased had been engaged in lengthening an electric cable, and that his visit bore out that idea. The workman had apparently disconnected a length and was in the act of joining two ends together when the explosion occurred. A spark would undoubtedly be caused at such a moment. For a pit in which safety lamps were used the design of the gate end box was very bad, no precaution being taken to have it enclosed and made perfectly gas tight. The plug connection was not suitable, and in his opinion the conditions at the colliery on the day of the explosion simply invited an explosion when gas made its appearance. The jury, in returning their verdict, expressed the opinion that a spark from the electric plant had ignited the gas and caused the explosion. They were also of opinion that whether or not the workmen were to blame in manipulating a "live" cable in the presence of gas, the employers were in fault in respect (1) that the examination by the acting fireman on the morning of the explosion had been perfunctory and insufficient to discover gas; (2) that the electric plant was not suitable for a fiery mine; and (3) that there was an absence of due inspection from time to time of the electric apparatus installed in the pit in question.

Swimming Gala.—The third Annual Swimming Gala of the County of London Electric Southern Athletic Club will take place (under A.S.A. laws) on Wednesday, September 15th, at the Wandsworth Baths. An interesting programme has been arranged, comprising club events, polo match, championship of the borough of Wandsworth, life-saving display (by ladies), and, as last year, an invitation team race, in which teams of four swimmers from electric supply companies and municipal electricity works are invited to compete. The invitation race was won last year by Richmond Electric, London Electric being second. In all seven teams competed. Teams wishing to enter should communicate with the hon. sec., Mr. H. Brown, Generating Station, The Causeway, Wandsworth, S.W., who will be pleased to forward any information desired.

Power Supply in the Transvaal.—A Johannesburg correspondent of the *Kolnische Zeitung*, in the course of an article dealing with the mines and electricity works in the Transvaal, sets forth the purely German point of view of the position, as compared with the standpoints assumed by the chairmen of the Victoria Falls and Transvaal Power Co., and at the same time gives some additional information. After stating that the establishment of a generating station at the Falls would at the outside serve local purposes later on, owing to the heavy loss in transmission, and that, moreover, coal in the Transvaal is so abundant and cheap that such long-distance transmission need not be considered, the correspondent refers to the beginning of activity of the Victoria Co., by the acquisition of the Rand Central Electric Works, at Brakpan, which was a company working with German capital, and the undertaking of the General Electric Power Co., which was created by the South African Goldfields Co. At the same time an

agreement was entered into with the Vereeniging Estates Co., which owns large deposits of coal at the Vaal River, whereby the latter granted to the Victoria Co. the right to erect a new power station on its property in return for the transfer of a number of shares, and the assumption of the obligation to purchase a certain quantity of coal at definite prices. The Victoria Co. then seemed to be assured of a monopoly until a new factor arose by the sudden appearance of a Mr. Harper, who offered more favourable terms to the principal mining companies on the Rand, and secured certain contracts for the supply of power. Mr. Harper first turned to the Allgemeine Elektrizitäts Gesellschaft for the financing of his contracts, which was already largely interested in the Victoria Co., and with the assistance of the former company, he formed the Rand Mines Power Supply Co., which took over the Harper contracts. There were thus two companies which, however, in the meantime have united in the sense that both have the same technical management and administration, and only possess separate boards of directors. After referring to the existing power stations and the works in progress, it is mentioned that the A.E.G. is the general contractor for the whole of the latter, and that the participation of German capital amounts to about 62 per cent. of the total capital. Prof. Klingenberg, of Charlottenburg, is the consulting adviser of both companies. The Rand Mines Power Supply Co. proposes to erect on the Rosherville dam, which is 6·2 miles distant from Johannesburg in an easterly direction, a central station which, in addition to a power transmission at 50,000 volts, will be supplemented by an air compressing station and a network of tubes to all the mines, in order to meet the requirements provided for under the Harper contracts. These installations will also be furnished by the A.E.G. The turbines to be provided are to be of 10,000 H.P., and the Rateau centrifugal air compressors are to be partly driven by steam and partly by electric motors. The Siemens-Schuckert Works Co. is also interested in these installations, whilst the A.E.G. will deliver all the motors, transformers and cables; the Lauchhammer Co. will supply the steel work, and the British Babcock & Wilcox Co. the boilers. The distribution from the Rand Mines Co.'s station will be by means of underground cables at 20,000 volts, and the contracts mainly concern the Rand mines and the Eckstein group, whilst the Victoria Co.'s contracts are with the Goldfields group, Barnato Bros., the General Mining Co., S. Neumann, and some of the Goerz mines. The charges to the end of 1910 amount to ·75d. per KW.-hour, ·5617d. to 1912, and ·525d. per KW.-hour subsequently, and the mining companies estimate that by the use of electric power they will be able to effect an economy of from 8d. to 1s. per ton of ore produced.

Electricity in Mines.—In his report on the southern mining district for 1908, the inspector (Mr. J. S. Martin), dealing with the use of electricity in mines, remarks that rapid strides are being made in the adoption of electricity in mines throughout the district of Cornwall, Gloucestershire (Bristol and the Forest of Dean), Kent, Monmouthshire and Somerset. It is used for pumping, haulage, and the working of coal cutters. According to the *Iron and Coal Trades Review*, in which the report is abstracted, he does not recommend the working of electric coal-cutting machinery at the working face in the fiery mines of Monmouthshire, but favours the use of air compressors underground as far in-bye in the in-take airway as it may be safe to work electrically, to supply compressed air to the coal-cutters at the face.

Electro-Metallurgy.—It is announced that the Gotthardwerke, Gesellschaft für Elektro-chemische Industrie, of Bodio, in the Canton of Tessin, which was formed in January, 1908, with the co-operation of German and Swiss firms for the purpose of producing high percentage ferro-silicon, will have its plant in full operation in November. The company utilises for the greater part the water-power works of the Biaschina of a capacity of 30,000 H.P., which were erected by the Aktiengesellschaft Motor, of Baden, one of the founders of the undertaking. A syndicate is said to exist in Paris for the sale of ferro-silicon, but the Swiss company is not a constituent of it, and its output will be disposed of by the firm of L. Weil and Rheinhardt, of Mannheim, which also participated in the formation of the company.

The German Electrical Industry.—A slight improvement is reported to have recently taken place in the condition of trade in Germany. If this is actually the case, it represents a change from the situation recorded some months ago, when orders were eagerly sought for, and even the large firms entered into keen competition for such small contracts as domestic installations, &c. This was the result of the unfavourable course of the trade in general, combined with the fact that manufacturing firms had largely extended their productive capacity in expectation of Government orders in connection with high-speed electric railways, or in the hope of the rapid realisation of city railway schemes. But the orders for railway conversion failed to make their appearance, in consequence of fiscal considerations, the weak financial situation and the cautious attitude of the States on the one hand, and owing to the rivalry of the town authorities interested in the projects for city railways on the other. In the circumstances the establishment of electrical financial banks has not accomplished its purpose, as neither Government nor municipal schemes have become ripe for financing, and the preparation of projects for country central stations offered a basis that was too inconsiderable, or was designedly postponed in order to await the progress of the extensive co-operative central station movement. Thus, the two electrical banks, whose scope will in future be hampered by the coupon tax and the tax on securities, have not yet been able to carry out a single transaction. These circumstances have rendered it necessary for the large works to secure orders with the object of keeping their thousands of workmen employed, but this has only been accomplished at a sacrifice in prices, and although these firms have reserve funds and auxiliary branches, the effect of the competition to obtain work will be specially reflected in the balance-sheets of the smaller firms. The condition of prices reached such a low level as could only be compared with 1901, which was the worst year of depression in the electrical industry. But during the past few weeks an improvement has been recorded, particularly in an increase in the orders placed by the mining and iron and steel trades, which are proceeding to install new plant. If the demand continues and expands, it is expected that prices will also become firmer, although progress will only take place slowly.

An 11,200-H.P. Turbo-Alternator.—A large steam turbine set of this output has recently been built by Messrs. Brown, Boveri & Co., for Buenos Ayres. The machine runs at 750-R.P.M., and consists of a Parsons type turbine with two three-phase generators for 7,500 KW. (8,350 K.V.A.), at 12,000—13,000 volts and 25 cycles, and for 8,825 K.V.A. at 12,500 volts and 50 cycles respectively, and a direct-coupled 110-KW. 220-volt exciter. The set can be overloaded to 14,200 H.P. for two hours. A surface condenser is used, and the steam is superheated to 300° C. The steam pressure is 176 lb. per sq. in. With cooling water at 15° C., the steam consumption is guaranteed at 14 lb. per KW.-hour, at a load of 7,500 KW. The condenser has a cooling surface of 13,800 sq. ft., and, with a sufficient supply of cooling water at 15° C., it can deal with 110,000 lb. of steam per hour, and produce a 95 per cent. vacuum. Even with cooling water at 25° C. it can give a 91 per cent. vacuum. The weight of the complete set, including the condenser, is 475 tons.

The turbine is divided into two cylinders with bearings between. This arrangement enables an especially large number of sets of blades to be used, arranged on the Parsons principle, thus ensuring a high efficiency, and, further, the high-temperature steam is confined to the comparatively small high-pressure compartment, and serious temperature deformation is avoided. Steam is admitted by two pipes to the regulating double-seated inlet valve at the top. This is operated by the compressed oil used for the lubricating system, instead of by steam, as has been usual in Parsons turbines. Consequently, any failure in the lubricating arrangements automatically cuts off the steam supply.

The spring governor, which controls a relay attached to the inlet valve, is mounted on the same vertical spindle which operates the oil pumps, and is driven by worm gear. The same spindle also carries the emergency governor, which comes into operation if the speed exceeds the normal by 15 per cent., and closes the main inlet valve. A second oil pump driven from the same worm gear works in parallel with the first, and both drive the oil under a pressure of 22 lb. per sq. in., through a cooler, to the bearings. The turbine spindles consist of steel cylinders, into which the journals with cast-steel spiders are forced and held by a bayonet joint. In order to ensure quick and uniform heating of these journals, heating chambers are provided, connected with the high-pressure steam. The two parts of the turbine spindle are connected by a flexible claw-coupling.

Both the stationary armature and the cylindrical rotating magnet are liberally provided with ventilating gaps. The cool air is driven through the machine from both ends by means of fans carried on the turbine spindle. The magnet core is formed of steel plates with radial slots, in which the flat copper winding is held by metal wedges in such a way that the centrifugal force acts on the flat sides, and no shifting can, therefore, take place. The ends of the magnet winding are held in by specially strong non-magnetic metal caps. Each generator can stand an overload of 25 per cent. for half an hour. The weight of one generator (7,500 KW.) without bearings or base plate is 73·4 tons—the armature being 48·1 tons, and the magnets 25·3 tons.

The Buenos Ayres central station, for which this set is intended, will eventually contain 10 Parsons turbo-sets of 11,200 H.P. each. Five of these are already on order, the above-described machine being one of them, and the remaining four being each fitted with a single three-phase generator of 7,500 KW. normal, or 9,000 KW. maximum output.

Bills Advanced.—On Wednesday last week, in the House of Lords, the London County Council (Tramways and Improvements) Bill was read a third time and passed.

On Friday, in the House of Commons, the Lords' amendments to the Central London Railway Bill were agreed to.

On Monday, in the House of Commons, the Lords' amendments to the Holywood Tramways and London County Council (Tramways and Improvements) Bills were agreed to, and the Barry Railway, Gateshead and District Tramways, and the West Kent Electric Power Bills were read a third time.

Educational.—KING'S COLLEGE, LONDON UNIVERSITY. The new session commences on October 6th; particulars are given in our "Official Notices" to-day.

Appointment Vacant.—LLANDILO.—Charge engineer for the U.D.C. See "Official Notices" to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Engineers.—MR. CHAS. T. LINNEY, manager and resident engineer of the Kent Electric Power Co., was recently the recipient of a silver salver and silver cigarette case, as a token of esteem and goodwill from the directors, staff and employés of the company, on the occasion of his leaving the company's service.

MR. ALBERT GAY, electrical engineer of Islington, has been appointed President of the Associated Municipal Electrical Engineers (Greater London) for the year 1909-10.

General.—In connection with the amalgamation of the Moss Bay Hematite Iron and Steel Co., Ltd., of Workington, the Workington Iron Co., Ltd., the Harrington Iron and Coal Co., Ltd., and Messrs. Cammell, Laird & Co.'s West Cumberland interests, MR. N. G. BARRACLOUGH has been appointed chief electrical engineer to the syndicate. For the past 4½ years Mr. Barraclough has been engaged as electrical engineer to the Moss Bay Iron and Steel Co., prior to which he was on the electrical staff of the National Boiler and General Insurance Co., Ltd., Manchester.

MR. GERALD HOOGHWINKEL, M.I.E.E., M.I.Min. and Metallurgy, will shortly leave England for Mexico on professional business, and intends to study the openings for British enterprise in that country with reference to contracts for public works. He would also be willing to take charge of special interests which might be entrusted to him.

MR. BEN. BAILEY has resigned his position with the "Z" Electric Lamp Co. to join Messrs. J. & H. Grevener, of Eldon Street House, E.C., as engineer and manager of their arc lamp department.

NEW COMPANIES REGISTERED.

Sylverlyte (1909), Ltd. (104,237).—This company was registered on July 24th, with capital £200,000 in £1 shares, to acquire any inventions relating to electric and other lamps, or any lenses, reflectors or other component parts or accessories for use in connection therewith, in particular to acquire patents No. 5,191 of 1904, and 10,696 in 1908, granted for the United Kingdom in respect of inventions relating to improvements in lenses and the benefit of foreign and colonial patents, granted or applied for in connection therewith, also to acquire the business and assets (except cash in hand) of the Sylverlyte Electric Lamp Co., Ltd., and to carry on the business of manufacturers of and dealers in lamps, reflectors, lenses and other articles, lense makers, electricians, opticians, glass blowers, engineers, manufacturers of and dealers in brackets, globes, films, shades, glasses, burners, meters, galvanometers, motors, batteries, wires, voltmeters, carbons, switches, insulators, &c. The subscribers are:—A. E. Berthoud, 9, Moorgate Street, E.C., merchant, 250 shares; J. S. Burns, Field Inn Lane, Pinner, managing director, 250 shares; T. E Dickinson, 2, Copthall Buildings, E.C., Member of Stock Exchange, 250 shares; H. Harker, 102, Upper Thames Street, E.C., merchant, 250 shares; S. F. Rumball, Copthall House, Copthall Avenue, E.C., Member of Stock Exchange, 250 shares; F. P. Baxer, 13, Sise Lane, Queen Victoria Street, E.C., accountant, 1 share; A. H. Skan, 4, Copthall Chambers, E.C., solicitor, 1 share. Minimum cash subscription 50,000 shares; the number of directors is not to be less than three or more than nine; the first are A. E. Berthoud, J. S. Burns, T. E. Dickinson, H. Harker, and S. F. Rumball; qualification, 250 shares; remuneration, £50 each per annum (chairman £100) and 10 per cent. of the distributed profits, divisible. Registered office, 13, Sise Lane, Queen Victoria Street, E.C.

Alba Lamp Syndicate, Ltd. (104,342).—This company was registered on July 29th, with a capital of £3,000 in 2,925 preferred ordinary shares of £1 each and 3,000 deferred ordinary shares of 6d. each, to acquire the benefit of and develop and turn to account a certain existing invention relating to a central reflector electric lamp. The subscribers (with one share each) are:—S. Fawns, 150, Finsbury Pavement House, E.C., consulting engineer; A. E. McCracken, 40, Ferreshaw Road, Chelsea, S.W., engineer. Private company. The number of directors is not to be less than two or more than seven; the first are S. Fawns (chairman), and A. E. McCracken; qualification, £2 10s. deferred ordinary shares; remuneration of chairman, £75 per annum; of ordinary directors, £50 each per annum. Registered office, 149-150, Finsbury Pavement House, E.C.

Barbados Electric Supply Corporation, Ltd. (104,367).—This company was registered on July 30th, with a capital of £60,000 in £1 shares (40,000 7 per cent. preferred and participating), to adopt agreements with the Anglo-American Debenture Corporation, Ltd., and to carry on the business of electricians, mechanical engineers, suppliers of electric, water and other power, manufacturers of, and dealers in, apparatus used in connection with the generation, supply, utilisation and distribution of electricity, &c. The subscribers (with one share each) are:—A. J. Brough, Torrington House, 183, Albion Road, Stoke Newington, N., accountant; L. Willoughby, Merstham, Surrey, registrar; M. H. Hearn, Hillview, Lanercost Road, Tulse Hill, S.W., clerk; R. Saward, The Hut, Woldingham, Surrey, clerk; W. J. Simpson, 35, King's Road, Willesden Green, N.W., clerk; F. Hopton, 46, Westbourne Road, Forest Hill, S.E., clerk; A. H. Coneybeare, 13, Alverstone Avenue, Wimbledon Park, S.W., clerk. Minimum cash subscription, 10 per cent. of the share capital offered. The number of directors is not to be less than two or more than seven; the first are Col. W. F. Leese, 23, Powis Square, W., and G. H. J. Hooghwinkel, 41, Chepstow Villas, Bayswater, W. So long as the Anglo-American Debenture Corporation, Ltd., hold 5,000 fully-paid ordinary shares they may nominate two directors; remuneration, £100 each per annum (chairman, £150). Registered office, 24, Martin's Lane, E.C.

Alfred Wiseman, Ltd. (104,365).—This company was registered on July 30th, with a capital of £15,000 in £1 shares, to take over the business of an iron and general metal founder, engineer, electric and tramway equipment and weighing apparatus specialist, manufacturer, &c., carried on by A. Wiseman at Vevus Works, and Globe Works, Glover Street, Birmingham, as "Alfred Wisemen," the "Electric Tramway Equipment Co.," "S. C. Parkes and Co.," and "F. & J. Allen." The subscribers (with one share each) are:—A. Wiseman, 89, Glover Street, Birmingham, engineer; J. W. Harris, The Laburnums, Bilston, engineer. Private company. The number of directors is not to be more than five; the first are A. Wiseman and J. W. Harris (both permanent); qualification (except governing director), £100; remuneration as fixed by the company. Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

"Electrical Engineer," Ltd. (104,347).—This company was registered on July 29th, with a capital of £1,500 in 1,425 preferred ordinary shares of £1 each and 1,500 deferred shares of 1s. each, to acquire the rights and property in connection with the newspaper or periodical known as the *Electrical Engineer*, to adopt an agreement with C. S. Sarle, and to carry on the business of newspaper and magazine proprietors and general printers and publishers, advertising agents, &c. The subscribers (with one ordinary share each) are:—C. S. Sarle, 38, The Avenue, Brondesbury Park, N.W., journalist; G. Cadogan-Rothery, 5, Fetter-lane, E.C., journalist. Private company. The number of directors is not to be more than five; the first are H. A. Gwyne, G. Cadogan-Rothery and C. S. Sarle; remuneration as fixed by the company. Registered office, 149, Fleet Street, E.C.

Traction Supplies Co., Ltd. (104,338).—This company was registered on July 28th with a capital of £5,000 in £1 shares, to carry on the business of electricians, electrical engineers, manufacturers of and dealers in fittings and accessories used in connection with electric traction, lighting or heating, &c., and to adopt an agreement with W. C. Thompson, W. M. Scott and A. White. The subscribers (with one share each) are:—W. C. Thompson, Grange House, Stockton Road, Sunderland, draper; W. M. Scott, 3, The Oaks, Sunderland, draper; A. White, 4, Eden Vale, Sunderland, electrical engineer. Private company. The number of directors is not to be less than three or more than seven; the first are W. C. Thompson, W. M. Scott and A. White; qualification, £50. Registered office, Gill Bridge Avenue, Sunderland.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Veritys, Ltd. (49,784).—Trust deed dated May 17th, 1909, supplemental to deed of October 31st, 1908, and modifying same for purpose of converting £60,000 debentures thereby secured into debenture stock, charged on the company's freehold and other property, present and future, including uncalled capital. Holders: Trustees, Executors and Securities Insurance Corporation, Ltd.

Lancashire Dynamo and Motor Co., Ltd. (61,447).—Issue on July 12th of £100 debentures, part of a series of which particulars have already been filed.

County of London Electric Supply Co., Ltd. (34,320).—Particulars of £500,000 first debenture stock, created by resolutions of various dates from January 23rd, 1899, to June 28th, 1909, and secured by trust deeds dated January 23rd, 1899, and July 5th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £100,000. Property charged: The company's undertaking and property, present and future. Trustees: Electric and General Investment Co., Ltd.

Hart Accumulator Co., Ltd. (60,059).—Mortgage dated July 15th, 1909, to secure £4,500 and 4 per cent. interest, charged on lands and premises at Stratford. Holders; G. A. Smith, H. A. Smith and F. Smith.

CITY NOTES.

Dublin United Tramways Co.

THE ordinary half-yearly meeting of the company was held in Dublin, on July 27th, Mr. W. M. Murphy presiding.

The CHAIRMAN, in moving the adoption of the report, said it would be seen that the receipts from passenger traffic were £347 less than in the corresponding half-year of 1908, which was more than accounted for by the extra day in leap year. A service of express cars had been instituted on the Dalkey line, which was much appreciated by residents of Blackrock and districts beyond, and it was intended to apply for powers to increase the speed on the line. "Other receipts" had increased by £750 and were made up principally of £630 parcel traffic, of which £441 was collected from passengers carrying parcels with them—a source of revenue which yielded about £1,000 a year to the company. On the expenditure side, working and general expenses were £3,420 less than in the corresponding half-year of 1908. The cost of generating and distributing energy had been reduced from ·402d. to ·366d. per unit; the decrease in maintenance costs, he attributed to the general use of steel tired wheels.

MR. C. LEHANE drew attention to the increasing taxation; between taxation, wayleaves, and income-tax, the company paid, he said, roughly £35,000 a year, while on ordinary dividends it paid its shareholders about £36,000 a year, or practically the same amount. A resolution was passed authorising the payment of a 6 per cent. dividend on the ordinary shares; £7,501 is carried forward, being £1,006 more than was carried forward in 1908.

Scottish Boiler Insurance and Engine Inspection Co., Ltd.—An interim dividend of 2s. per share, free of income-tax, on the ordinary shares for the past half-year is announced.

City of London Electric Lighting Co., Ltd.—A dividend on account of the year 1909 on the ordinary shares of 5s. per share, less income-tax, has been declared, being the same as declared last year.

Metropolitan Electric Supply Co., Ltd.—The directors have declared an interim dividend of 5 per cent., less income-tax, on the ordinary shares for the past half-year, the same as last year.

Straits Settlements (Bertam) Rubber Co.—Dividend of 4½ per cent.; £1,036 carried forward.

Anglo-American Telegraph Co., Ltd.

The half-yearly meeting of the proprietors of the Anglo-American Telegraph Co., Ltd., was held on Friday, July 30th, at Winchester House, E.C., under the chairmanship of Mr. F. A. Bevan.

In moving the adoption of the report (see Electrical Review, July 30th, page 189), the Chairman said he had to congratulate the shareholders upon the increase in their receipts during the past half-year, as compared with the corresponding period of 1908. The receipts had increased by £14,500, and the receipts of the ss. *Minia* had increased by about £3,000, making a total increase of £17,500. The expenses, on the other hand, had decreased by £950. As, however, they brought forward a smaller balance, the net result was that the increase available for distribution was £17,451 12s. 8d. If they looked at the report and accounts up to the end of June, 1908, they would find that in that statement a diminution of £17,500 was shown, so that, in the past year, they had made up what they had lost in the previous year. The increase was due to general business, and especially to receipts from stock business messages, which business was the invention of their general business manager, and had proved a very fruitful source of income. There seemed to be generally an improved condition of things with the trade between this country and the United States, and therefore they might hope, so far as they could see, that they would have good results during the next half-year at least. The renewal fund had also increased during the year by £21,380, although they had had to debit that fund with £13,000 special repairs, with £5,700 general repairs, and with £15,250 on account of the repairs to the 1874 cable. They heard at the last half-yearly meeting that their cable was broken, and owing to the wintry weather it was impossible for them to undertake any operation at the time for repairing the fault. They had been most unfortunate with the weather ever since, and it was still bad, and he regretted to say that up to the present they had not been able to complete the repair of the cable. They hoped, however, in a short time to get on to rather shallower ground where the cable had a good bottom instead of a bad bottom where up to now they had been operating. They would have to debit the renewal fund with some more money during the current year on account of that cable, and they could not say what the total cost would be until the repair to the cable had been completed. So far as they could see, the breakages to the cable on the western side of Ireland were mainly due to the reckless conduct of fishing trawlers who carried on their operations where the cables were known to be laid, and up to the present they had used some 400 miles of cable in repairing cables on the north-west side of Ireland. Only within the last few days they had received a letter from the secretary of Lloyd's, stating that a trawler had picked up 75 fathoms of telegraphic cable whilst fishing 35 miles from the coast, and this proved to be one of their old cables, either the 1865 or the 1866 cable. As they knew, a Committee, representing the Board of Trade, the Admiralty and the Fishery Boards, inquired into the question of breakages of cables by trawlers, and at that inquiry the cable companies proposed that the trawlers should be prohibited in the shallow waters of the Irish coast where cables were known to be laid. The Committee, however, would not agree to this, but as an alternative, recommended that the trawlers should be examined by Government officials. The fact that they had heard of this picking-up of the cable showed that the provisions made were not sufficient. They had informed the Post Office of this fact, and they hoped it would lead to more stringent regulations being adopted in regard to trawlers. With reference to their renewal fund, it would be remembered that some time ago he stated, when they set aside £90,000 against depreciation of their securities, that he did not consider it likely there would be any appreciation for some time to come. The appreciation up to the present had amounted to about £13,000. With regard to the suggestion for reducing rates, the companies in the Atlantic were not disposed to make any reduction at present, as far as Press rates were concerned, for there was no room for it. Suggestions had been made for reducing the rates for social messages, and there might be something put before them by the Post Office in that direction. All he could say was that they might be quite certain that whatever the result of the agitation, the directors would consider the interests of the shareholders, as well as the interests of the public. They wished to give the public the best possible service at the lowest possible cost, but at the same time they had to consider the interests of the shareholders, and they did not see at present that there was room for much reduction.

Sir Gerald Fitzgerald seconded the motion, and the report was adopted.

W. T. Henley's Telegraph Works Co., Ltd.—The directors have declared an interim dividend on the preference shares at the rate of 4½ per cent. per annum, less income-tax, and on the ordinary shares at the rate of 10 per cent. per annum, as last year, free of income-tax, for the half-year ending June 30th last, both payable September 1st.

Mumbles Railway and Pier Co.—The report for the half-year ended June states that after payment of dividends due to the Swansea and Mumbles Railways under the agreement of 1898, there is an available balance of £1,986. The directors recommend a dividend at the rate of 6½ per cent., leaving £89 to carry forward.

Kepitigalla Rubber Estates.—There is a balance of £10,950 after providing £2,500 towards preliminary expenses. No dividend is recommended until the question of additional capital is settled

South American Light and Power Co., Ltd.—The report for the year ended March 31st last, to be presented to the meeting to be held on the 10th inst., states that the net profit for the year, after writing off a further sum of £550 against the cost of the dynamo, is £5,274, which, added to £147, the amount brought forward, makes the total sum available £5,422. The directors recommend the payment of a dividend of 4 per cent. and also the payment of interest at the rate of 4 per cent. per annum on the £15,961, further capital expenditure incurred during the year by the railway company, which interest amounts to £274. There will remain a balance of £627 to be carried forward. The above-mentioned capital expenditure will be satisfied by a cash payment of £461 and the allotment of 15,500 shares fully paid to the Bahia Blanca and North-Western Railway Co., Ltd., making the total amount of share capital issued £128,500. The 50 per cent. of the gross receipts payable to this company under its agreement with the Bahia Blanca and North-Western Railway Co. for the past year amounted to £12,991, against £8,889 in the previous year, showing an increase of 46 per cent. The directors consider that the increase in the business during the past year has again been very satisfactory. In accordance with the terms of the working agreement between this company and the Bahia Blanca and North-Western Railway, the latter having subscribed for £30,000 of the capital of the company were entitled to appoint a second director to the board, and therefore on September 23rd, 1908, they appointed Mr. Frederick Oldershaw Smithers in the place of Mr. Charles Murray Wilkins, resigned.

Singapore Electric Tramways, Ltd.—The report for 1908 shows an excess of revenue over expenditure of £24,294, against which has been charged debenture interest, depreciation and royalty, amounting to £28,335, showing a loss for the year of £4,040. The severe depression in trade in Singapore showed no abatement during 1908, and as a consequence the tramway revenue shows a decrease of $20,176 as compared with 1907. The demand for energy for lighting and power purposes shows a satisfactory increase—the receipts from this source in 1908 being 94 per cent. higher than in 1907. The new bridge over the Singapore River is still not completed, and it will be some months before plate-laying can commence on it, and so enable the company to link up section 6 and section 3 of the tramways. Work in connection with the new wet dock and the deviation of Keppel Road necessitated thereby is proceeding satisfactorily, and it is expected that the construction of the tramway on the new road will commence before the end of the year.

Stock Exchange Notice.—Applications have been made to the Stock Exchange Committee to appoint a special settling day in and to grant a quotation to the following securities, and to allow them to be quoted in the Official List :—

Chiswick Electricity Corporation, Ltd.—£80,000 4½ per cent. first mortgage debenture stock.

Anglo-Argentine Tramways Co., Ltd.—640,000 5 per cent. cumulative first preference shares of £5 each, fully paid, Nos. 1 to 640,000; 500,000 5 per cent. cumulative second preference shares of £5 each, fully paid, Nos. 800,001 to 1,300,000; and £1,733,380 4½ per cent. debenture stock, in lieu of the first, second and third preference shares now quoted.

National Boiler and General Insurance Co., Ltd.—The directors propose a dividend on 15,000 shares, at the rate of 6s. per share, free of income-tax, for the half-year ended June 30th, 1909, requiring £4,500; bonus of 2s. per share, £1,500; to add to current risk and reserve fund, £9,000; to write off furniture, fittings and instruments account, £500; balance to carry forward, £6,865; total, £22,364.

Chilian Electric Tramways and Lighting Co., Ltd.—The report for 1908, presented to the meeting yesterday, shows a credit balance of £8,832, which, with £1,712 brought forward, makes a net balance of £10,545. From this sum £8,000 has been transferred to renewals reserve account, leaving £2,545 to be carried forward. The Chilian currency has suffered still further depreciation in 1908, the rate of exchange being on an average about 9 1/16d. per peso (at one time falling as low as 7½d.), and adversely affected the profits earned. The company has carried 68,342,366 tramway passengers, earning $5,696,868, as against 61,451,234 passengers, earning $5,011,363 in 1907. The receipts for light and power during 1908 amounted to $3,681,118, as against $2,658,254 in 1907, showing a satisfactory development in this department. It is hoped shortly to be able to meet all demands that may be made upon the company's power and lighting plant, with the advent of hydraulic power—the installation of which is nearing completion.

Stratford-on-Avon Electric Light Co.—The second ordinary meeting was held on Wednesday, last week, Mr. G. M. Bird presiding. In moving the adoption of the report, the chairman referred to the satisfactory progress being made; the works had only been in operation 20 months, so they could scarcely expect to be able to distribute anything in that time. During the year they had instituted a system of rented wiring, which had proved a good thing for the company; for the six months to July, 1909, as against the corresponding six months, they had added some 30 consumers, and sold 11,571 additional units, which meant £178 added revenue. After some discussion, the report was adopted, and Mr. G. M. Bird was re-elected a director; Mr. J. McGregor was also elected, in place of Mr. Paterson.

South Metropolitan Electric Tramways and Lighting Co., Ltd.—The directors announce that the question of the payment of a dividend on the preference shares is deferred until the accounts for the whole year are in their hands.

Lancashire Power Construction Co., Ltd.

The directors report that in accordance with the resolutions passed at an extraordinary general meeting of shareholders held on November 11th, 1908, and confirmed on November 26th, 1908, an issue of £150,000 5 per cent. first mortgage debenture stock was made in November last, and was fully subscribed. Of this sum £61,500 was required to discharge the commitments of the company, leaving a balance of £88,500 available for developing the business of the Parliamentary company of which this company is the sole proprietor. It was only in the autumn of last year that the present board (comprising three members of the old board) was constituted and took up the active management of the company's affairs, the *personnel* of the board of this and the Parliamentary company being now identical. The period, therefore, covered by this report has been one of re-organisation, the first results of which will only become apparent during the course of the current year's work. With regard to the Parliamentary company: The plant at the generating station, and in the sub-stations, has been maintained in good condition, and, together with the mains, is proving itself reliable in operation. Some difficulty has, however, been experienced under certain conditions in maintaining an adequate draught for the boilers, and an induced draught installation has been ordered and is now in course of erection, which will doubtless entirely overcome this trouble. Various extensions of the mains have been made in order to supply new power users, the most important being an overhead line of over three miles in length to Turton. This and all other extensions to the mains have been carried out by the company's own staff. The board are able to report that the restrictions imposed in the earlier days of the company on overhead high-tension lines have now been largely removed, and the company has succeeded in negotiating wayleaves on reasonable terms for nearly all the important extensions which have recently been desirable, the cost of carrying out such extensions being greatly reduced thereby. As regards the prospects of the company, there is a very marked improvement. The Board of Trade have given their assent to the transfer of a large number of electric lighting orders from various local authorities to the Parliamentary company, thereby indicating that their confidence in the stability of that company has been re-established. Several contracts of considerable magnitude have recently been received for the supply of electrical energy, and although the full benefit of these contracts will not be felt until the year 1910, they will substantially add to the current year's revenue. At the close of the period covered by the accounts, 5,960 H.P. had been connected with the company's mains out of a total capacity of 12 000 H.P. Since then a considerable number of additional orders have been secured, and at June 30th, 1909, approximately, 6,590 H.P. was connected with the mains, besides a further 1,160 H.P. arranged for, but not yet connected. One of the chief objects of the directors in their capacity as the board of the Parliamentary company has been to arrive at an agreement with the Radcliffe Council whereby the company should supply large power users whose power requirements are too extensive for the Council to deal with from their own generating station, and protracted negotiations, having this object in view, have taken place with the Council. No agreement has, however, yet been reached. The directors are, nevertheless, hopeful that having regard to the undoubted advantage which such an arrangement would confer upon the district, a satisfactory agreement may yet be come to. Messrs. Callender and Carolan are the retiring directors, and offer themselves for re-election.

Mr. H. F. Parshall (chairman) presided over the annual meeting of the Lancashire Electric Power Co. and of its affiliated company, the Lancashire Power Construction Co., Ltd., at Salisbury House, E.C., on July 29th.

In moving the adoption of the report, the Chairman said the reorganisation of the company was not completed till the end of 1908, so that the new directorate had only been in existence for a period of six months. Matters were very much at a standstill until the financial position of the company was put on a proper basis, but, since the reorganisation, steady progress had been made, and more satisfactory contracts had been entered into now that it has been realised that the company was in a strong financial position. He was pleased to say that the B. of T. had sanctioned the transfer from the local authorities to the company of a considerable number of lighting orders. These lighting orders were a valuable asset to the Lancashire Co., in that the districts were in general along the trunk mains of the company, and, in consequence, a supply of electricity could be given with comparatively small capital outlay. One of the most satisfactory developments was in connection with the supply of electric power to collieries. It was thought that the business of the Lancashire Co. would be largely confined to cotton mills, but, as a matter of fact, a number of collieries were finding it to their advantage to take a supply of electricity from the power company, and it was anticipated that the business of the company would show considerable development in this direction in the future. During the last six months the output had increased something like 30 per cent., while the total costs of production were actually less than those of the corresponding period of last year, the revenue increase being £1,500. This was especially satisfactory considering the great depression in trade in the Lancashire district during the last 12 or 15 months, and the satisfactory increase was to be accounted for by the fact that the advantages of the company's supply were getting to be better understood by the Lancashire manufacturers. Many of the customers of the company, after a thorough trial, had decided to complete the electrical equipment of their works. There appeared to be a growing feeling of confidence in the districts generally. Various improvements were being carried out in the power station, and economies effected in the cost of generation, and new connections, were of a satisfactory nature. The policy of the board had been, first, to reduce the loss on working, and, secondly, only to expend money when there was a certainty of such an expenditure bringing additional revenue. During the year a L.G.B. inquiry was held at Radcliffe, the local authority in whose district the power station was situated. The attitude taken up by the L.G.B. was to discourage the development of the Radcliffe Urban District undertaking for the purposes of power generation, and a recommendation was made to the effect that the position of their company should be taken into consideration by the Radcliffe authorities. Radcliffe was practically the only local authority with which the Lancashire company was not on the best of terms. Having regard to the advantages of a power scheme in such a district, the position taken up by the Radcliffe Council was impossible to understand. The directors had many times met the Radcliffe authorities with a view to arriving at a better understanding, but their efforts had so far met with no encouragement. For this reason, it had appeared to the directors advisable to apply to the B. of T. for an order to supply electricity in the Radcliffe district. There were most important customers in this district who were willing to deal with this company, and it was hoped that this phase of the business might take a satisfactory turn, especially considering the attitude of the Board of Trade in respect to such matters, as evidenced by the Bill they were supporting. The board and the management had worked together in complete harmony and with a single object in view, namely, to leave no stone unturned to secure the success of the undertaking.

Sir R. A. Hampson, in seconding the motion, congratulated the shareholders upon the distinct change for the better which had taken place since the reorganisation of the concern last autumn. It was a change for the better as regarded their credit with the Board of Trade, their relations with the local authorities, and in connection with the applications for new business which were going on month by month. Of course, the results would not be shown until they were in a position to present the next annual report, as the new organisation did not take complete effect until a very late period in 1908. The board had every confidence that with the increased connection which were now being made, month by month, and the improved position of the company generally which had resulted from their being in a position to discharge all liabilities and leave them nearly £90,000 for the purpose of extending the business, their efforts in a reasonably short time would be crowned with success. At all events, they would be in a position next year to present a report and accounts which they believed would give satisfaction to all concerned.

The report was adopted without discussion and the retiring directors re-elected.

Rio de Janeiro Tramway, Light and Power Co., Ltd.

The report for 1908, to be presented at the annual meeting to be held to-day, states (according to the *Financial Times*) that the hydro-electric plant at Rio das Lages is practically finished. The large dam was finished and the reservoir completely filled before the end of the year, since which time the water has been flowing over the dam, as the flow in the river has been sufficient to supply all the power required without drawing upon the reserve in the reservoir. The transmission lines have been completed, and an independent telephone line constructed during the year, connecting the power house at Rio das Lages with the terminal station at Rio de Janeiro. The terminal station building has been finished, and the electrical equipment has all been installed and is now in regular use, and there remains to be done only the adjustment of this apparatus and the completion of the wiring about the station. Three 800-KW. motor-generators have been installed for the tramway service, and the sub-foundations and other preliminary work have been completed in this building for the additional machinery which will be required for the operation of the entire tramway system. The sub-foundations have also been completed for the gas engine units which will be installed in this building as a reserve for the public street lighting. There has been a great disturbance to the service of the tramways due to the reconstruction and electrification. This reconstruction has interfered seriously with traffic, it being impossible to maintain a satisfactory service at all times during such a period. In consequence of these various causes, a very considerable percentage of the gross income of the tramways has been lost, and the total gross income for the past year shows very little increase over the previous year. While the new electric lines were opened late in the year and it has been impossible to utilise the electric cars to their full advantage on account of the reconstruction, and consequently to reduce operating expenses to any material extent, yet the ratio of the net income to gross income of the tramways has been increased from 38·61 per cent. in 1907 to 42·19 per cent. in 1908. Close attention has been paid by the company to the development of its power business. Until January 1st, 1908, the various companies which are controlled by this company, were operated as separate concerns, but from this date the operation of these companies was taken over by this company under operating contracts and leases, so that the earnings of the various companies appear for the first time in the financial statements of this company. During the past year the company has sold $956,600 first mortgage bonds, this being the remainder of the total issue. There were also sold during the year 35,000,000 fr. of the French issue of the second mortgage bonds and £900,000 of the sterling bonds of this same issue were sold by public issue in London. Since the date of the

public issue a further amount of £50,000 of this issue has been sold by private sale, making a total amount of £950,000 outstanding of these sterling bonds on December 31st. The net revenue from operation after deduction of operating expenses, maintenance, taxes and other fixed charges in Rio Janeiro, was $2,730,434, from which must be deducted the fixed charges and interest on loans at head office, leaving a net surplus after the payment of all expenses and fixed charges for the year of $870,236. An opportunity being presented of acquiring about 75 per cent. of the shares of the Jardim Botanico Tramways Co., thus assuring a controlling interest of the company, the board considered it wise to purchase these shares, as that company has a large and lucrative business in one of the best residential sections of the city, and can be operated to good advantage in connection with the other tramway systems under the control of this company, as well as assuring to this company an important contract for the power required for the operation of the system. While the purchase of these shares was made since the beginning of this year, and consequently, strictly speaking, should not be included in this report, yet (in view of the great importance of this acquisition to the company) the board felt that the shareholders should now be informed.

Metropolitan Railway Co.

The ordinary half-yearly meeting of the shareholders of the above company was held on the 28th ult. at the Great Eastern Hotel, Sir Charles McLaren, M.P., in the chair.

The Chairman, in moving the adoption of the report, said that the accounts showed a substantial increase in receipts and a very satisfactory saving in expenses. The locomotive and generating expenses were less by about £11,000, but as they had received about £7,000 less for working trains for other companies, the net saving was £4,000. There had been an increase of £12,600 in the receipts from passenger traffic, although the Exhibition traffic to Wood Lane had not been so good. There had been increases during the half-year from the traffic on practically all sections of the line, and he thought there could be no doubt that the public were beginning to realise, in a way they had not done before, the advantages of the electric underground train services generally, and of the facilities offered for interchange at various points. Including season ticket-holders, they had carried during the half-year 49,647,166 passengers, as against 48,243,951, or an increase of 1,403,215, and their receipt per passenger was slightly higher, being 1·48d., as against 1·46d. in the corresponding period. The parcels traffic showed a satisfactory increase of about £1,400. They had charged out of the half-year's revenue £5,000 to the electrical renewal and depreciation fund. That fund now stood at the very substantial figure of £53,162. They thought it wise to have a strong fund of this character not wholly for the purposes of actual depreciation, as the electrical plant was maintained so far as possible in a condition of thorough working efficiency out of the ordinary revenue, but mainly for the purpose of enabling them to take advantage of improvements in electrical machinery which might from time to time be brought out with a view to cheapening the cost of producing energy. They were at the present time engaged upon the work of increasing the horse-power capacity of their generators at Neasden, and it was satisfactory to know that when one of these machines was taken to pieces for the purposes of alteration a few weeks ago, after having been in constant service for two years, it was found by the contractors to be in as good a condition as when it was first put up, and to show practically no sign whatever of wear and tear. This was, of course, very gratifying to them, but at the same time they felt, for the reasons he had stated, they were wise to continue to build up a strong renewal fund, having regard to the fact that electrical science was still in its infancy. In a matter of this kind the board felt that they were best consulting the interests of the shareholders generally by looking beyond the immediate present and making a safe provision against possible contingencies which might seriously affect the company's revenue in future years. The balance available for dividend was £137,075, as against £122,514 in the corresponding period, when they took nothing out in respect of depreciation and renewals. They proposed, after paying the full 3½ per cent. on the several preference stocks, to pay 1 per cent. on the ordinary stock, and to carry forward £3,904 to the next half-year's accounts. The dividend was still a small one, but the fact that it was double what they were able to pay 12 months ago was, he thought, very clear evidence of a satisfactory turn in the affairs of the company. On July 1st they made an important alteration in the train services, and commenced to run about a dozen trains through from their extension line to the City in the busy hours of the morning and a similar number of through trains back to the districts served by the extension line in the evening. Some of these through trains were run to and from Aylesbury, others to and from Uxbridge, and others to and from Harrow only. The saving of the change at Baker Street, morning and evening, was a very great convenience to passengers, and they hoped, as time went on, to increase the number of these through trains. They had found very great advantages to accrue from the system of automatic signalling which they had installed on the Inner Circle, and they had in contemplation an extension of this system of signalling on the northern line as far as Neasden, as the train service there was now so heavy as to necessitate a quicker method of signalling than the existing manual system. They would be glad so see from the reports in the papers a short time ago that the Bill promoted by the North-West London Railway Co. was rejected by the Committee of the House of Commons. If the Bill had been passed and the line made as proposed, it would have been to all intents and purposes an extension of the Baker Street and Waterloo Railway from Edgware Road to Kilburn in direct competition with their line. They opposed the Bill very strenuously, and it was with no small amount of satisfaction that they learnt that the Committee would not sanction its proceeding.

Sir W. Bibt seconded the resolution.

Replying to a Shareholder, the Chairman said it was quite true that the £5,000 placed to the electrical renewal and depreciation fund was an arbitrary figure, but looking at their reserve fund, and considering the fact that the British Westinghouse Co. were putting down fresh turbines for them at their own expense, they considered that they would not have been justified in charging a larger sum to depreciation out of the year's accounts.

The report was adopted.

Zircon-Tungsten Lamp Patents.

The report for 1908-9 of the Compagnie Internationale des Lampes Electriques Zircon-Wolfram, of Brussels, which was the pioneer in the introduction of the Zircon-Wolfram lamp in various parts of the world, contains interesting information relating to the progress made in the past year, together with the announcement that after efforts extending over three years, the inventors of the Z lamp at Berlin have been granted both patents by the German patent office, notwithstanding the severe attacks made by the most powerful competing companies. As the negotiations for the working by a Vienna lamp factory of the patents for Austria-Hungary did not yield the results which were expected, the report states that the company in association with the Italian Edison Co., has formed a separate company under the title of the Société des Lampes Electrique Z pour l'Autriche-Hongrie, whose recently erected factory at Rovereto, in the southern Tyrol, was now in full operation. An independent company was also formed last autumn for the working of the Z patents in Sweden, Norway, Denmark, and Finland, the manufacture of the lamps having been placed in the hands of the Glödlampfabrik, of Stockholm, which commenced production in March of this year. Of the various subsidiaries, the Spanish and Italian companies yielded excellent results for a first working year. The other factories which did not enjoy from their erection the same technical and commercial facilities, had not yet reached the dividend-paying stage, whilst the Russian company had been compelled to increase its share capital owing to the development of the business. The Z Electric Lamp Manufacturing Co., of London, whose daily production already amounted to several thousands of lamps, had also entered the era of profits. In the case of the Société des Projectionnements aux Lampes à Filaments Métallique, in which the Brussels company holds all the "capital shares," had declared a dividend of 30 per cent. on the amount paid up on this class of shares, and 8s. per share on the dividend shares. The patents for the Z lamp for Argentina, Brazil, and Uruguay had been sold to a syndicate formed by the Italian, Spanish, and Austrian companies, and the syndicate expected through the agencies obtained in these countries, to easily dispose of the surplus production of the Mediterranean factories during the dead season in Europe, which is the favourable season in South America. Negotiations in respect of Portugal had been concluded since the end of April, and Greece would be a favourable customer for the Austrian company in the autumn. The directors were still awaiting the grant of the Japanese patent, and in the meantime the option given to a leading London firm continued in operation. An interest amounting to 40 per cent. had been acquired in the Z lamp patents for the United States, where the use of electric lamps was greater than in the whole of Europe, and reached 100,000,000 lamps per annum. At present negotiations were proceeding with the representatives of a Franco-American financial company, and their conclusion depended upon the issue of the American patents, one of which had already been granted, and the other was momentarily expected. As to the competition of other metallic-filament lamps, the report contained a reassuring remark that although the high prices at first charged could not be maintained, a large increase in sales had followed the reduction in prices. On the other hand, the more the production advanced, the more the cost of manufacture diminished, so that the financial results of the companies whose shares were held in portfolio, pursued a rising curve. The accounts show net profits of £4,800 on a share capital of £48,000, and a dividend at the rate of 8 per cent. for 1908 09 has been declared.

The Chatham and District Light Railways Co.—The seventeenth ordinary general meeting (Electrical Review, July 23rd, page 147) of the shareholders of the above company was held on Thursday of last week at the offices, 83, Cannon Street, Mr. A. R. Monks presiding. The chairman formally proposed the adoption of the report, which was seconded by Mr. H. C. Levis, and agreed to.

Midland Railway Carriage and Wagon Co., Ltd.—The directors propose a dividend on the ordinary shares at the rate of 7½ per cent., free of income-tax; a bonus of 10s. per share on the ordinary shares; dividend on the preference shares, 6 per cent., free of income-tax; balance carried forward, £3,382. £2,000 is set apart for depreciation of plant.

Oxford Electric Co., Ltd.—An interim dividend at the rate of 5 per cent. per annum on the ordinary shares for the half-year ended June 30th has been declared. Last year the rate was the same.

Continental Electrical Enterprise Co.

The Continentale Gesellschaft fur Elektrische Unternehmungen of Nuremberg, which is partly an investment company and partly owns and works electric railways or tramways and supply stations, states in its report for 1908 that although the effects of the economic depression were perceptible in the working of the undertakings, the latter experienced a further satisfactory development. The Augsburg tramways were transferred to the local authority last September, and the negotiations for the sale of the undertakings at Grevenbroich and Sigmaringen had been completed. As gross profits the accounts show the sum of £125,870, as compared with £130,120 in 1907, and the net surplus amounts to £70,940, as against £70,630 in the preceding year. It is proposed to pay a dividend at the rate of 4 per cent. on the preference share capital of £1,556,000 out of the total share capital of £1,600,000, being the same as in 1907. The interest payments on the bond capital, totalling £433,500, as contrasted with £446,000 in 1907, were provided for before arriving at the amount of the net surplus. The working results of various undertakings are set forth as follows:—

	Percentage Dividends.		
	1906.	1907.	1908.
Bergische Kleinbahnen	3	3	3
Augsburg Tramways	6	7	—
Zwickau Electricity and Tramways	6	6	6
New Berlin Tramways, North-East	—	4½	4½
Krakau Tramways	4½	4½	4½
Vienna Local Tramways	4	4	4
Rhenish Schuckert Co.	6	7	7
Elektra Co.	3½	3½	4
Société Industrielle d'Energie Electrique	3	3	3
Société Continentale de Traction et d'Eclairage	3	3	3
Chemin de Fer sur Route de Paris à Arpajon	4½	4½	4½
Società Sicula Imprese Elettriche	4½	4	4½
Società Toscana per Imprese Elettriche	8	9	10
Società Torinese di Tramways	6⅕	6⅕	6⅕
Compania Madrilene de Traccion	—	1	—
Compania Madrilena de Electricidad	—	6	6
Sociedad Electro-Quimica de Flix	—	6	7
Tramways de Constantinople	6	5	5

The receipts of the Barmen-Elberfeld-Vohwinkel suspended electric railway, which is owned by the company, amounted to £66,250 in 1908, as compared with £66,450 in 1907, and the expenses were £38,650 and £38,450 in the two years respectively. Among the assets are to be found the company's own undertakings, entered at £1,093,000, syndicate investments at £609,000, and securities at £900,000, together with debtors totalling £143,500, mostly composed of credits granted to subsidiary companies.

Mexican Light and Power Co., Ltd.

The annual report for the year ended December 31st, 1908, states that, during the past year, the actual and prospective demands for power, in the centres of consumption supplied by the company, increased beyond the most sanguine expectations, and that to meet these demands, it has been decided to double the capacity of the present hydro-electric plant at Necaxa during the next three years, and to bring into the Necaxa Basin, by a series of diverting and storage dams, canals and tunnels, the waters of the Lower Tenango, Nexapa and Catepuxtla Rivers, which are included in the water rights granted to the company by the Federal Government of Mexico, but which rights it was not, until recently, believed that the company would have need to exercise for many years to come. The advent of cheap electric power to Mexico City and its suburbs, and to El Oro and vicinity, has so reduced the operating costs of all industrial enterprises located in these places, that existing industries have extended their operations and many new undertakings have been and are about to be established. In some cases during the past year it has been deemed advisable to supply electrical energy to customers of the company by the operation of the company's steam plants during the dry season at a considerable loss, pending the completion of the hydraulic works of the company. During the present year, if the company had decided to restrict its operations to the supply of power which its present customers are entitled to receive, its net earnings would have been equivalent, after paying all fixed charges, sinking fund and preference stock dividends, to over 8 per cent. upon its ordinary shares.

On January 1st the electrical installations connected to the company's distributing lines in the City and Federal District of Mexico and in El Oro and vicinity represented, approximately, 79,000 h.p., distributed as follows:—

Public lighting.—1,810 arcs	1,470 h.p.
Private lighting.—No. of 16-c.p. equivalents—388,500	27,250 h.p.
Power.—Motor units, Federal District	22,783 h.p.
Electric heaters	1,085 h.p.
Tramways	8,710 h.p.
El Oro Mines and vicinity	17,775 h.p.
Total connected	79,073 h.p.

There was an increase of 11,720 h.p. in the connected load during the year 1908; and a similar increase is anticipated during the year 1909, making a total connected load of 90,000 h.p. by January 1st, 1910. The maximum power generated during the past year was 45,000 h.p., or nearly 60 per cent. of the total connected load. The present maximum hydro-electric generating capacity of the company's plant, including the San Ildefonso stations, is 50,000 h.p.; but the directors are carrying forward improvements to and extensions of the present works which, it is expected, will increase the present capacity to 66,000 h.p. by July next; and by which, when required, at least three generating units of 16,000 h.p. each may be added, if necessary, one each year thereafter, up to a total capacity of 124,000 h.p.

During the past year the Laguna Dam and the provisional dam at Los Reyes were completed, and are now available for the storage of water. The dam at Necaxa, which will be the largest of its kind ever constructed, necessitating the use of 1,634,000 cb. metres of material, is now over one-half completed. It should be finished during the present year. The height of this dam, when completed, will be 58 metres (190 ft.) above its foundations. The quantity of water actually stored for use on January 1st, 1908, was 4,000,000 cb. metres; while on January 1st, 1909, it was 25,000,000 cb. metres. Nevertheless, owing to its being deemed hazardous and impracticable to use the Necaxa Dam for any considerable storage of water during the past year, over 40,000,000 cb. metres of water were necessarily wasted. Considering that each cubic metre of water stored represents a value of about 3¾ cents, Mexican currency, when compared with the cost of producing electrical energy by steam in Mexico city, the importance to the company of the large storage works now in progress is readily realised. Two new dams are now in course of construction on the Lower Tenango and Nexapa Rivers. The waters of the Catepuxtla River are being diverted by a tunnel, 336 metres in length, into the Nexapa reservoir, where they will join the waters of the Nexapa River, and thence flow into the new Tenango reservoir, and through the new Tenango tunnel, 1,300 metres in length, into the Necaxa reservoir, which is located in the basin of the Necaxa river, at an elevation of 443 metres above the site of the present power house. By means of this diversion the present power house may be extended to more than twice its present capacity.

Financial.—The gross earnings for the year 1908 were $2,938,474 gold, as compared with $2,880,000 gold in the previous year, and similarly the operating and maintenance expenses were $1,080,570 gold, as compared with $1,075,000 gold. In Mexican currency the actual gross earnings during 1908 were:—Public lighting, $463,265; private lighting, $2,869,586; Mexico and Federal District Power, $1,316,907; El Oro, $783,576; and tramway, $443,613; making a total of $5,876,947. The general accounts for the year show that the amount brought forward from December 31st, 1907, less appropriations and expenses, together with the earnings during 1908, gave a sum of $3,656,495.64 (gold); this sufficed to meet operating and maintenance expenses, bond interest and sinking fund, dividends to December 31st, 1908, on preference shares, dividends of 3½ per cent. on ordinary shares, leaving a balance of $910,823.43 carried forward to the credit of the profit and loss account.

At a special general meeting of shareholders, held on December 31st last, a resolution respecting the proposed lease of the company's undertaking to the Mexico Tramways Co. was held to be *ultra vires*. More recently the Tramways Co. officially intimated that its offers were withdrawn, and negotiations were now at an end.

Great Northern and City Railway Co.—The report for the half-year ended June 30th last states that the total revenue for the six months just ended amounted to £40,801 and the cost of working to £21,040, being at the rate of 51·56 per cent. The net revenue amounts to £19,761, which is insufficient to meet the company's fixed charges for the half-year. The sum of £3,209, which has been provided from outside sources, has enabled the company duly to meet these charges. The number of passengers for the six months under review, including season-ticket holders, was 6,041,755, as against 6,875,662 for the corresponding period last year. The decrease in the number of passengers carried is due to the competition of the L.C.C. electric tramcars.

Blackpool and Fleetwood Tramroad Co.—The report for the half-year ended June 30th last, states that the balance of profit, after providing for debenture interest, is £4,685, and the directors recommend a dividend at the rate of 4 per cent. per annum, writing off £750 to depreciation reserve, and £500 to general reserve account, leaving a balance of £435 to be carried forward. The number of passengers carried during the half-year was 963,460. The receipts from all sources amounted to £11,910.—*Financial Times*.

Charing Cross, West-End and City Electricity Supply Co., Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum on the ordinary shares of the West-End undertaking.

Charing Cross, Euston and Hampstead Railway Co.—The directors have declared a dividend at the rate of ⅝ per cent. per annum. Last year, after providing for interest and rents, a balance of £832 remained.

Baker Street and Waterloo Railway Co.—A dividend at the rate of 1½ per cent. per annum on the ordinary stock, which will be made up to 3 per cent. per annum, except in the case of those shares held by the Underground Electric Railways, has been declared. Last year ⅝ per cent. per annum was paid out of net revenue, and the dividend was made up to 3 per cent. for the same shares.

Hadfield's Steel Foundry, Ltd.—The directors have declared an interim dividend of 1s. per share on the ordinary shares.

G.N., Piccadilly and Brompton Railway Co.—The directors have declared a dividend at the rate of 1 per cent. per annum. Last year the distribution was at the rate of ⅝ per cent. per annum.

MARKET QUOTATIONS.

Wednesday, August 4th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	"	28/-	..
a " Sulphuric	"	5/6	..
a Ammoniac, Sal	"	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a "	"	£30	..
a Bleaching powder	"	£5 10	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£16	..
a Copper Sulphate	"	£18 10	..
a Lead, Nitrate	"	£25 10	..
a " White Sugar	"	£23 10	..
a " Peroxide	"	£52	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a " Chlorate	per lb.	3½d.	..
a " Perchlorate	"	3½d.	..
a Potassium, Cyanide	"	7d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	"	£6 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5	..
a Soda, Caustic (white 70 %)	"	£10 15	..
a " Chlorate	per lb.	3½d.	..
a " Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a " Cyanide (basis 100 %)	"	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£70	..
b " Wire, in ton lots	"	£112	..
b " Sheet, in ton lots	"	£120	..
p Babbitt's metal ingots	"	£50 to £135	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¾d.	¼d. inc.
c " Tube (brazed)	"	8¼d.	¼d. dec.
c " " (solid drawn)	"	7¾d.	¼d. dec.
c " Wire, basis	"	6¾d.	¼d. inc.
c Copper Tubes (brazed)	"	8¾d.	¼d. inc.
c " " (solid drawn	"	8¾d.	¼d. inc.
g " Bars (best selected)	per ton	£71	£1 inc.
g " Sheet	"	£71	£1 inc.
g " Rod	"	£71	£1 inc.
e " (Electrolytic) Bars	"	£60 5	..
e " " Sheets	"	£77	..
e " " Rod	"	£65	..
e " " H.C. Wire	per lb.	7¼d.	..
f Ebonite Rod	"	3/8	..
f " Sheet	"	3/-	..
n German Silver Wire	"	1/6	..
h Gutta-percha, fine	"	..	..
h India-rubber, Para fine	"	8/5	7d. inc.
l Iron Pig (Cleveland warrants)	per ton	49/7	1/3 inc.
l " Wire, galv. No. 8, P.O. qual.	"	£14	..
g Lead, English Ingot	"	£12 15 to £12 17 6	5/- dec.
m Manganin Wire No. 28	per lb.	8/-	..
c Mercury	per bot.	£8 5	..
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d " " medium	"	2/6 to 4/-	..
d " " large	"	4/6 to 8/6	..
p Phosphor Bronze, plain castings	"	1/- to 1/1	..
p " " rolled bars & rods	"	1/1½ to 1/3	..
p " " rolled strip & sheet	"	1/2½ to 1/6	..
o Platinum	per oz.	95/-	variable.
e Silicium Bronze Wire	per lb.	9½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	"	£131 10 to £132 10	£1 10 inc.
n " Wire, Nos. 1 to 16	per lb.	1/8½	..
p White Anti-friction Metals:—			
"White Ant" brand	per ton	£35 to £60	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	£25 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Dublin and Lucan Electric Railway Co.—The directors' report, to be submitted to the shareholders at the half-yearly meeting of the company, on August 19th, says:—After providing for debenture interest there is an available balance of £1,153, out of which the directors recommend the payment of the usual half-yearly dividend on the 5 per cent. preference shares, which will absorb £475; that £250 be allocated to Messrs. Dick, Kerr & Co., further on account of the sum still due to them on account of electrical equipment, thus reducing that debt to £350; and that the balance of £428 be carried forward to next half-year.

Continental Notes.—The Great Northern Telegraph Co., of Copenhagen, reports a net profit of £407,702 for the last financial year, as compared with £434,600 in the preceding 12 months. A dividend of 45 fr. per share is being declared.

La Société Force-Eclairage par Electricité, of Brussels, is declaring a dividend of 2½ per cent for the last financial year.

STOCKS AND SHARES.

Tuesday Afternoon.

After the accumulation of the holiday's orders had been cleared off in the markets, business settled down into a placid quietude that is likely to be the normal condition through the present month. Rubber shares are the most active in the whole of the Stock Exchange, and while the prudent prophesy ever more and more loudly that there will be a severe slump, the buoyancy of rubber itself, of course, supports the market most effectually.

The pacification of the coal trade dispute naturally brought about a swift rally in Home Railway prices, and the various bull points once more came to the front. The unfortunate market has made so many false starts—recovery only to be succeeded by relapse—that it is no wonder people rather fight shy of putting much faith in a fresh rise. However, prices are decidedly better again, and that is something. The electrical issues hardened a little in tone, but price movements are insignificant. City and South London regained part of the deducted dividend of 17s. 6d. per cent.; Metropolitan Ordinary stocks rose to 40½. Districts are quietly steady.

Telegraph descriptions retain their rises, without having made any further noticeable improvement. The market has been in a decidedly holiday frame of mind, with business at a very low ebb. Anglo-American Telegraphs continue strong, but the alterations in the general list—what few there are—consist chiefly of the falls incidental to *ex* dividend markings. Telephones are similarly quiet National Telephone Deferred and Preferred are each *ex* 3 per cent., and the Preference shares are also *ex* dividend, the deductions being reflected in quotations. The 3½ per cent. Debenture stock is ¼ up. American Telephone and Telegraph capital stock marks a rise of 2, upon the extraordinary strength displayed by the American Railroad market.

Copper, and copper shares, both of which are largely swayed by American influences, suffered a check to their rise, and prices are moving more irregularly, though still without producing any effect upon shares in the manufacturing or kindred companies. Henley's have gained a further ⅛. Crompton Debenture shed 1. Willans and Robinson Preference are ⅛ lower. The armament shares are firm. Interest in trading shares, however, clings most closely to the rubber market, where the demand for the product has resulted in a regular boom for all rubber shares. Mincing Lane feeds the Stock Exchange activity; while the gamble appeals but little to the general public, the latter are well catered for by shoals of new companies, good, bad and indifferent. It is to be noticed that in only a comparatively few cases are premiums quoted on these newcomers, after allotment has taken place.

Mexican Canadians are easier on the whole, although Electrical Development of Ontario bonds rose 4½ to 90. Mexican Light and Power and Mexico Trams are weak. Rio Trams fell 1½, and Sao Paulo declined to 147½. Canadian General Common is 123, and the Preferred 117. British Columbia Electric Railway Deferred rose a point, and a private correspondent, lately home from Vancouver, paints the prosperity of the British Columbia Company in glowing terms.

Anglo-Argentine Trams are a good market, the Second Preference gaining $\frac{1}{16}$, and the Third Preference being firm at $4\frac{7}{16}$. The Company's 4 per cent. Debenture stock at about 91½ pays nearly 4½ per cent. on the money, allowing for accrued dividend, and the security appears to be ample. Auckland 5 per cent. Debenture is a point higher. There has been a little business in Winnipeg Electric Railway 4½ per cent. Debenture stock on the basis of 102½. London United Tramways Preference change hands at about 45s., and British Electric Traction Preference shares and the Second Debenture stock are lower, the latter falling 2 per cent. Movements amongst electricity supply descriptions are too slight to call for comment.

Calcutta Electric Supply Corporation.—An extraordinary general meeting of this company was held on Friday of last week at the offices, Salisbury House, London Wall, Mr. E. Boulnois presiding. The chairman remarked that the matter for which they were called together was purely a formal one. The company, under a recent Act, had to insert in their Articles of Association a limit as to how much commission should be paid to underwriters and others. The directors proposed a limit of 10 per cent., not because they would be compelled to give that amount, but in view of any contingencies that might arise, he thought it was desirable that some figure should be put in. He accordingly moved: "That Article 82 of the company's Articles of Association be amended by the addition of the words 'but such commission shall not exceed 10 per cent.' immediately after the words 'placing its shares' in the said article." Sir Guilford C. Molesworth seconded the resolution, and it was carried.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations July 27th.	Closing Quotations Aug. 3rd.	Business done week ended Aug. 3rd, 1909. Highest.	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,350 Red.	100	5 %	5 %	5 %	5 %	92 — 96	92 — 96	..	..	..	5 4 2
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7¼ %	8 %	8 %	8 %	143½—144½	146½—147½	..	..	+3	5 8 6
$68,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 0 10
558,460	Anglo-American Telegraph	Stock	3⅛%	3⅛%	3⅛%	£3 4s.	58½ — 60½	58 — 60	..	..	..	5 5 7
3,220,770	Do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	102½—103½	101 —102	103	101	—1½	5 17 8
3,220,770	Do. do. do. Deferred	Stock	1½	12½	1 %	8/-	17½ — 17⅞	17⅞ — 17⅞	17 7/8	17½	..	1 11 2
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	103 —105	103 —105	..	..	..	4 15 3
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8⅛ — 8½	8 — 8⅜	..	..	..	4 14 1
2,431,350	Commercial Cable, Sting. 500 year 4% Deb. St. Red.	Stock	4 %	4 %	4 %	4 %	89 — 91	89 — 91	89½	..	..	4 7 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8¾ — 8⅞	8⅛ — 8¼	..	..	..	6 15 6
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞ — 3⅛	2⅞ — 3⅛	..	..	..	5 3 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅛ — 8¾	8¼ — 8¾	..	..	..	5 12 8
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	3 16 8
60,710	Direct United States Cable	20	4½%	4½%	4½%	4½%	12⅜ — 13⅛	12⅜ — 13⅛	13⅛	12 13/16	— ½	6 13 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,300, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	125 —128	125 —128	126	125	..	5 7 8
2,000,000	Do. 5½ % Pref. Stock...	100	5½%	5½%	5½%	5½%	84½ — 86½	84½ — 86½	86½	85⅝	..	4 0 0
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½—106½	104½—106½	104⅝	104½	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11⅛ — 12	11⅛ — 12	11 13/16	11⅛	..	6 19 2
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	104 —106	104 —104 xd	104½	..	..	3 16 11
200,000	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	5½%	10½ — 10⅝	10½ — 10⅝	10⅝	..	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13½ — 13⅝	13½ — 13⅝	13⅝	..	..	4 7 8
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26 — 27	26 — 27	..	..	..	6 13 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51½ — 53½	51½ — 53½	..	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½ %	4 %	4 %	80 — 84	80 — 84	..	..	..	4 15 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 79	74 — 79	..	..	..	5 5 3
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	6 0 7
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	2 — 2⅛	2 — 2⅛	..	..	..	5 13 3
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	109 — 110½	106 —107½	106½	106	—3	5 11 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	125½—127½	122½—124½	126½	123	—3	4 16 5
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¾ — 11	10 — 10⅞	..	..	— ⅛	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10¾ — 11	10 — 10⅞	..	..	— ⅛	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	5⅛	..	— ⅛	4 6 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	97 — 99	98 —100	..	..	+1	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 8
179,318	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 15/16 — 1 17/16	1 15/16 — 1 17/16	..	..	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref...	1	6 %	6 %	6 %	6 %	1 15/16 — 1 17/16	1 15/16 — 1 17/16	..	..	..	5 8 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	85¼ — 87½	85¼ — 87½	..	..	..	4 11 5
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	99 —101	99 — 101	..	..	..	3 19 3
11,889	Reuter's	8	5 %	5 %	5 %	5 %	7⅜ — 8⅛	7⅜ — 8⅛	..	..	— ⅛	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	100⅜	..	..	4 9 1
3,042	Submarine Cables Trust	Certs.	6 %	6 %	6 %	6 %	130 —133	130 —132	130½	..	— ½	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	7⅛ — 7⅜	6⅞ — 7⅛	7⅛	6 15/16	..	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 10 3
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	13½ — 14	13⅝ — 14	..	..	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102½—104½	101⅝—104½	102⅜	..	..	3 16 7
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8 — 8½	8 — 8½	8	..	..	7 1 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£3 6	15 %	8 — 9	8 — 9	..	..	..	17 2 4
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

890,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,007	5	8 %	8 %	9 %	10 %	9¼ — 9⅜	9 5/16 — 9 7/16	9 7/16	9 5/16	+ 1/16	5 5 3
978,230	Do. 4 % Deb. Stock	..	..	..	..	..	90¾ — 91¾	90¾ — 91¾	91½	90	..	4 6 6
882,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	101 —103	102 —104	..	..	+1	4 16 2
580,000	Babcock & Wilcox, 1 to 580,000..	1	20 %	20 %	20 %	20 %	4⅛ — 4⅜	4⅛ — 4⅜	85/7⅛	85/-	..	4 11 1
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜ — 1½	1⅜ — 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	2 — 2⅛	2 — 2⅛	..	..	..	48 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1⅞ — 2	1⅞ — 2	..	..	..	46 2 1
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3 — 3¼	3 — 3⅛	..	..	..	8 11 5
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2¾ — 3⅛	2⅞ — 3⅛	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	94 — 99	93 — 96	..	..	—2	5 14 7
600,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	143 —147	141 —148	147½	146½	+1	5 8 1
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	122 —126	119 —123 xd	123	122½	..	4 17 7
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —110	107 —110	106¾	..	..	4 10 11
283,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
400,000	British Electric Traction	10	3 %	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	1½%	2⅛ — 2⅜	2 — 2⅛	..	..	— ⅛	6 0 0
1,178,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	86 — 90	86 — 90	88	..	..	5 11 1
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	66 — 70	64 — 68	..	..	—2	6 12 4
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	6 9 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛ — 6⅜	6⅛ — 6⅜	..	..	— ⅛	4 11 3
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
204,940	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16 — 7/16	3/16 — 7/16	5/-	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	38 — 42	..	..	..	9 10 6
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	⅜ — ½	⅜ — ½	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 — 48	43 — 48	..	..	..	9 8 8
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4½ — 4⅞	4½ — 4⅞	96/3	..	..	4 12 4
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4⅝ — 5	4⅝ — 5	97/6	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 12 0
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10 — 10⅜	10 — 10⅜	..	..	..	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 13 1
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	104½—106½	104½—106½	..	..	..	4 4 6
491,225	Cape F. Trams., 1 to 491,229	1	Nil	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	5/9	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	1⅝ — 2	1⅞ — 2	88/9	..	..	6 0 0
210,168	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	108 —106	104 —107	..	..	+1	3 14 2
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½%	61 — 63	60 — 62	62⅜	60½	—1	5 4 10
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	83 — 85	83 — 85	83	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	..	..	..	5 11 1
1 [illegible]	City and South London Railway	Stock	1⅞	2⅜	2½%	1½%	31½ — 32½	31 — 32	..	..	— ½	4 13 9
85,000	Crompton & Co., Nos. 1 to 85,000	1	2½%	5 %	5 %	5 %	½ — 1	½ — 1	..	..	..	15 0 0
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	91 — 94	90 — 93	..	..	—1	5 7 6

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations July 27th.	Closing Quotations Aug. 3rd.	Business done week ended Aug. 3rd, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1906.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
200,000	Dick, Kerr & Co., 1 to 200,000	1	10 %	10 %	10 %	10 %	1⅛ — 1¼	1⅛ — 1¼	..	..	..	8 0 0
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000 ..	1	6 %	6 %	6 %	6 %	1⅝ — 1¾	1⅝ — 1¾	..	..	..	4 16 0
271,080	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	99 —102	100 —103	..	..	+1	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13— 14	12⅞— 13⅜	..	..	— ⅛	4 7 8
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4½ %	4½ %	2½ %	..	⅜— ⅝	⅜— ⅝	..	..	..	25 0 0
17,189	Do. "A" shares, 01—017,189 ..	5	4½ %	4½ %	2½ %	..	1¼— 2⅛	1¼— 2⅛	..	..	..	5 0 0
307,995	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	84 — 87	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	⅞— 1⅛	⅞— 1⅛	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890..	3	7 %	7 %	7 %	7 %	1⅛— 1⅜	1⅛— 1⅜	..	..	— ⅛	4 9 7
26,000	General Electric Co. (1900), 8 % Cum. Pref. ..	10	8 %	8 %	8 %	..	7⅞— 8	7⅞— 8	..	..	..	6 5 0
800,000	Do. do 4 % Mort Deb..	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
75,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 75,000	10	4 %	4 %	¼ %	Nil	⅜— 1	⅜— 1	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼— 10⅜	10¼— 10⅜	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12 — 12⅞	12⅛— 12⅞	12½	..	+⅛	5 18 6
40,000	Do. do. 4½ % Pref.	5	4½ %	4½ %	4½ %	4½ %	5⅛— 5⅜	5⅛— 5⅛	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	105⅜—107⅝	105⅜—107⅛	..	..	..	4 3 9
60,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	14⅜— 15½	14⅜— 15½	15½	14⅛	..	6 11 2
37,500	Liverpool Overhead Railway, Ord.	10	Nil	Nil	⅛	Nil	⅛— ¼	⅛— ¼	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	6 — 6	6 — 6	..	..	..	8 6 8
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	Nil	1⅛— 2⅛	1⅛— 2⅛	..	..	..	Nil
899,980	Do. do. 50,008 to 100,000	10	3 %	3 %	3 %	Nil	1⅛— 2⅛	1⅛— 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3⅜%	2 — 2⅜	2 — 2⅜	50/-	..	..	15 0 0
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	..	4 %	68 — 71	68 — 71	70⅜	67	..	5 12 8
5,722,052	Metropolitan Consolidated	100	2½%	1 %	1½%	⅝%	40½— 41	40⅜— 40⅝	40⅝	39⅝	..	1 10 6
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	67 — 69	65 — 67	67⅛	65¼	—2	4 2 1
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	17⅛— 17⅜	17⅛— 17⅜	17⅛	17⅜	..	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	⅜— ⅝	⅜— ⅝	..	..	..	..
314,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	⅛— ⅜	⅛— ⅜	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	15/8— 15/9	15/8— 15/9	16/-	15/6	..	5 19 5
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	95 — 97	95 — 97	9 ⅛	..	..	4 12 9
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	126 —129	123 —126	128	120	—3	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	93 — 95	93 — 95	94	13	..	5 5 3
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅜— ⅝	⅜— ⅝	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1⅝— 2	1⅝— 2	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
87,250	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ — 36	34 — 35½	34	..	— ½	2 10 9
140,000†	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99½—101½	99½—101½	..	..	..	3 18 10
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	102½—103½	102½—103½	..	..	..	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 — 89	87 — 89	89	..	..	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	36 — 38	36 — 38	..	..	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅜— ⅝	⅜— ⅝	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2⅞— 3⅛	2⅞— 3⅛	..	..	— ⅛	1 18 1
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4½— 4⅝	4½— 4⅝	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	8 — 8⅛	8 — 8⅛	8⅛	..	..	5 17 8
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8⅛	8 — 8⅛	..	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	4 — 4⅛	4 — 4⅛	..	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛— 5	4⅛— 5	..	..	..	4 10 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞— 4⅛	3⅞— 4⅛	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	3 19 3
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝— 4⅛	3⅝— 4⅛	80/-	..	..	5 9 1
175,000†	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10½— 11	10⅝— 10⅞ xd	..	..	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13	11⅞— 12⅜ xd	..	..	..	4 12 4
400,000†	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	100⅜	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2⅝— 3⅛	2⅝— 3⅛	..	..	..	3 6 8
60,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	3⅞— 3⅞	3⅝— 3⅝	..	..	— ⅛	6 17 11
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93¾— 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	3⅝— 8⅝	7⅝— 8⅜ xd	8⅛	..	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜— 11¼	10⅜— 11	..	..	— ⅛	5 9 1
400,000†	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	103 —106	103 —106	105	..	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	⅛— ⅝	⅛— ⅝	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref. ..	5	6 %	3 %	Nil	Nil	⅛— ⅝	⅛— ⅝	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	59 — 62	58 — 61	60	..	—1	7 7 7
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	84½— 86½	84½— 86½	86	85½	..	5 16 3
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅝— 5	4⅝— 5⅛	..	..	+ ⅛	5 7 4
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	97 —100	..	..	—1	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅞— 7⅞	7⅞— 7⅞	..	..	..	5 11 6
$1,375,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	97½—100½	97½—100½	..	..	..	4 19 6
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	6⅞— 7⅛	6⅞— 7⅛	..	..	..	5 8 6
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 — 100	95 — 98	..	..	—2	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	8	4 %	4 %	2½%	3 %	1⅞— 2⅛	1⅞— 2⅛	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref. ..	6	6 %	6 %	6 %	6 %	5⅛— 5⅝	5⅛— 5⅝	..	..	..	5 11 8
282,255	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅞— 4⅛	4⅝— 4⅞	88/9	..	+ ⅛	5 5 3
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	..	..	..	4 10 0
235,000†	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
348,000†	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½— 86½	+3½— 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	82 — 84	82 — 84	83⅞	83½	..	5 1 5
13,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	67 — 71	65 — 69	67⅛	67½	—2	4 17 3
$4,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	104 —108	104 —108	..	..	..	5 17 8
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	88 — 90	85½— 87½	89½	88½	—2½	5 12 4
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	91 — 97	94 — 97	..	..	..	4 12 9
180,451	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	8 %	2½%	4⅜— 5⅛	4⅜— 5⅛	..	..	..	2 10 0
18,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4⅜— 5⅛	4⅜— 5⅛	..	..	— ⅛	5 0 0
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 — 101	99 —101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11½— 12½	11½— 12½	..	..	..	5 14 3
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6⅛	6 — 6⅛	..	..	..	5 7 8
60,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	95 — 98	..	..	+1	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	6 %	1⅝— 1⅞	1⅝— 1⅞	..	..	..	5 7 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1⅝— 1⅞	1⅝— 1⅞	..	..	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	5 8 1
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8⅞— 9⅛	8⅝— 9	9⅛	..	— ⅛	7 2 10
70,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	7⅞— 7⅞	7 — 7⅛	..	..	..	4 11 10
150,000†	Do. do. 5½ % Deb. Stock Red. ..	100	5½%	5½%	5½%	5½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	⅛— ⅜	⅛— ⅜	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	8 %	4 %	5 %	2⅜— 3⅛	2⅜— 3⅛	..	..	..	6 9 0
125,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	⅞— 1	⅞— 1	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛— 1⅛	1⅛— 1⅛	..	..	..	5 6 8
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —104	..	..	+ ½	4 6 7
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅛— 1	⅛— 1	..	..	..	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅜— 2⅛	1⅜— 2⅛	..	..	..	11 15 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 83	76 — 80	..	..	—3	5 12 6
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	⅝— ⅞	⅝— ⅞	..	..	..	5 6 8
110,000	Westminster Electric Supply, Ord.		13 %	12 %	10 %	10 %	8⅝— 9⅛	8⅝— 9⅛	..	..	..	6 11 2
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	4⅛— 5⅛	4⅛— 5⅛	..	..	..	4 3 9

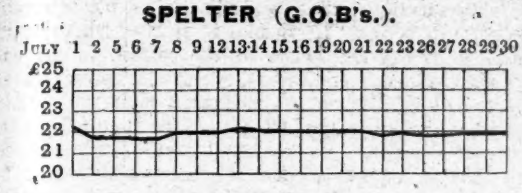
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st, 1909.

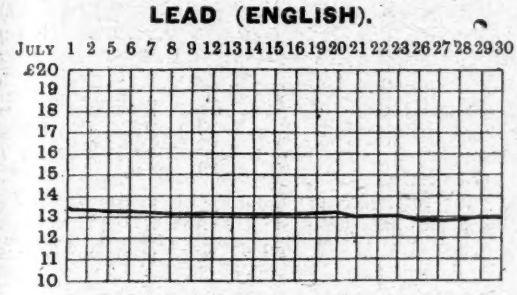
METAL MARKET.

Fluctuations in July.

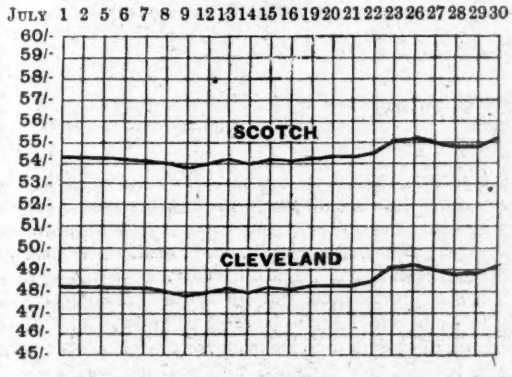
SPELTER (G.O.B's.).



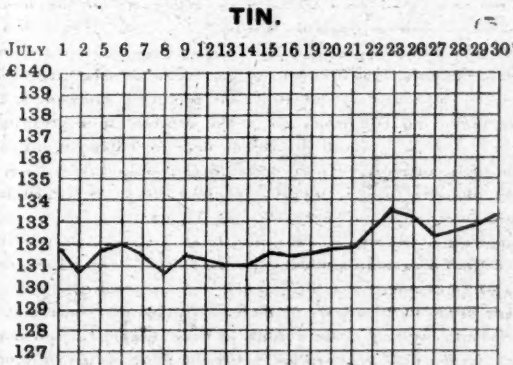
LEAD (ENGLISH).



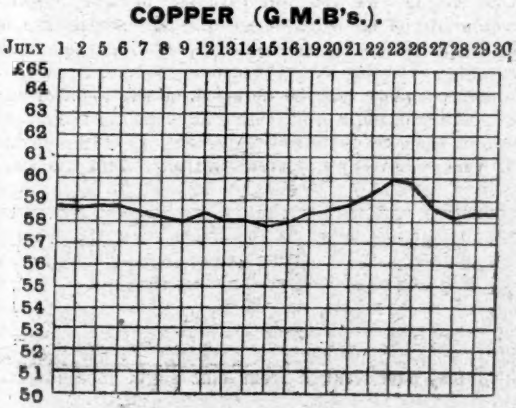
IRON.



TIN.



COPPER (G.M.B's.).



DETROIT RIVER TUNNEL ELECTRIC LOCOMOTIVE.

THE first of six direct-current locomotives for the tunnel under the Detroit River has been finished, and the acceptance test completed. The locomotives are designed for hauling both freight and passenger trains through the tunnel, and also for switching service at the terminal. The tunnel will connect the Western Detroit yards of the Michigan Central Railroad and the new Windsor yards, Windsor, Ont., the electrified zone embracing the tunnel with its approaches, terminals, tracks and sidings extending over approximately 33,000 ft. The specifications demand a maximum service consisting in hauling a 1,800-ton trailing train up a 2 per cent. grade at a speed not less than 10 miles per hour, with two locomotives operating as multiple units; and the capacity must be such as to enable them to repeat the trips with this weight of train continuously with a lay-over of 15 minutes at each end, and without undue heating of the motors. The total weight of the locomotive is 199,000 lb.

The motor equipment consists of four 300-H.P. commutating-pole motors. The gearing between motor and axle has a 4·37 reduction, and the driving wheels are 48 in. in diameter. With this reduction each motor will develop a tractive effort of 9,000 lb. at the rail head, which gives a total tractive effort for the four motors of 36,000 lb. at 12 miles per hour. The motors have an overload capacity sufficient to slip the driving wheels, and the locomotive can develop at the slipping point of the wheels an instantaneous tractive effort of 50,000 lb. to 60,000 lb. The maximum speed of the locomotive running light upon a level track is about 35 miles per hour.

There are two gears and pinions per motor, one at either end of the armature shaft. This construction was adopted on account of the unusually heavy torque and excessive overloads that the motors will be called upon to carry. In large sizes of motor equipments, with a gear and pinion at only one end of the shaft, it has been asserted that a large proportion of the wear and breakage of pinions is due to the tilting of the motors under heavy loads, which concentrates the pressure at one end of the tooth. The form of construction adopted in the Detroit locomotives will eliminate any such danger.

The motors are designed for forced ventilation. Air is delivered into the motor frames at the end farthest from the commutator, passes between the field coils and around the armature, and finally escapes through suitable discharge openings over the commutator. The blower used for this purpose has a capacity of 2,000 cb. ft. of air per minute at 2¼ in. of water pressure, and is driven by a direct-current series motor. This blower delivers air to the passage between two centre-sills, from which the ventilating ducts are tapped off to the motors at appropriate points.

The control system used is the Sprague-General Electric multiple-unit type, with two master controllers in the main cab and the contactors in the auxiliary cab. Multiple-unit connections are fitted, so that three locomotives may be operated in unison if necessary. The problem of starting and accelerating a train of from 1,000 tons to 1,500 tons weight, which may consist of 40 or 50 cars, is a rather difficult one. Such a train is not a rigid mass, but a long elastic body, and any inequality in the starting torque results in waves of jerking and buffing strains which may reach abnormal values in some parts of the train. Consequently the control for these locomotives was designed especially to produce a uniform increase of speed and torque during the period of acceleration. The control combinations are so arranged that the motors may be operated four in series, two in series and two in parallel, or four in parallel. There are nine resistance steps in series, eight in series-parallel and seven in the parallel position. In a test run with a train of 1,578 tons weight, consisting of one locomotive and 26 freight cars, the acceleration from a standstill to 10 miles per hour was accomplished with marked smoothness. The maximum increase of draw-bar pull was about 6,500 lb. on the first few steps, after which the maximum throughout the remainder of the acceleration was from 2,000 lb. to 3,000 lb. To an observer standing in the caboose (*anglice*, guard's van) of such a train, the rear end of the train is started so gradually that the beginning of the motion is almost imperceptible; the contrast with the results obtained with a steam locomotive is thus very striking. The locomotive is equipped with third-rail shoes to take current from an inverted third-rail. It is also fitted with an overhead trolley, which can be raised or lowered by a foot-operated valve in front of the motorman. The electrical part of the equipment was supplied by the General Electric Co., the locomotive having otherwise been built at the Schenectady works of the American Locomotive Co.—*Electrical World*, N.Y.

Lignite as Station Fuel.—The use of lignite as fuel in generating stations is increasing in Germany, where stations continue to be erected in the vicinity of lignite deposits, or the electricity companies purchase the mines or lease the production. Combinations of lignite mines with power stations already exist in the Weissenfels district, at Helmstedt and Schwandorf in the Upper Palatinate, and the Electricity Supply Co. of Berlin has now arranged with the Hercules Brown Coal Co., of Zittau-Hirschfeld, for the supply of lignite for the overland central station to be erected in Oberlausitz.

REVIEWS.

Vectors and Vector Diagrams applied to the Alternating-Current Circuit. By W. Cramp, M.I.E.E., and C. F. Smith, M.I.E.E. London: Longmans, Green & Co. 1909. Price 7s. 6d. net.

The authors give a methodical description of vectors and vector diagrams. They assume that the reader has a sound knowledge of electrical phenomena and of the nature of everyday electrical apparatus, but the demands made on his mathematical knowledge are of the slightest. We take it, therefore, that the book is intended to be useful to students and to the large class of electrical engineers—and the reviewer includes himself in this class—who find it difficult to understand the principles involved in many of the vector diagrams so lavishly used by writers of technical papers. The diagrams are often in close accord with experimental results, but the methods by which they are deduced from first principles are sometimes open to question. It was with a view, therefore, of having some of these points cleared up that we studied this work. On the whole we were disappointed. The authors follow the methods of Steinmetz pretty closely, but some of the proofs given are far from convincing. They deserve praise, however, for making their meaning always clear. And possibly it is not advisable to discourage the beginner too much by pointing out the shakiness of the foundations. The arrangement of the matter and the drawing of the diagrams are also good.

A list of symbols, abbreviations and conventions is first given, and hence the necessity of much tedious iteration is avoided. The symbol $\sim$ for frequency we do not much like, as it gives many of the subsequent equations an Oriental appearance, and it disguises very effectively even old friends. Following the fashion of many electrical engineers, they take the clockwise direction as the positive direction of rotation for vectors. Why vectors should differ from other things we have never been able to make out. In teaching elementary mathematics it is the universal custom to take the counter-clockwise direction as positive. Why should students have all their previous conventions upset when they come to an electrical college? Is the study of electricity such a solemn matter that the uninitiated have either to rid themselves of all previous prejudices, or to stand on their heads, before they begin to study it?

The wonderful operating factor j rotates a vector through 90° in the *counter-clockwise* direction. To be strictly logical, we think that the authors should have denoted $-\sqrt{-1}$ by j.

We think that the student reading the introductory note would get the impression that Prof. Steinmetz was the first to apply the method of the complex variable to the study of electrical problems. As a matter of fact, Heaviside and Rayleigh had published many important results obtained by this method previous to 1886, and for 20 years before that many of the very difficult electrical problems set in the college and university examination papers at Cambridge were supposed to be solved by the students by this method. In our opinion the main credit of applying the method in all its generality to physical problems belongs to Gauss and Stokes. The elementary theory required by electricians was explained by Argand (1806). A translation of this book was published by Van Nostrand in New York in 1881.

We think it necessary to restate all this, as many electricians believe that Steinmetz invented the theory of the complex variable. We are not aware of "more academic systems suggested by various mathematicians," or that there are "complications incidental" to their use.

The ordinary reader would have some difficulty in understanding the introductory note about "equivalent sine waves." The authors state that the method can be used to solve "almost all problems connected with alternating-current circuits." It is rather unkind to the reader, however, to leave him in ignorance of when the method fails. This lack of knowledge must weaken his confidence in applying the method, even in those cases in which it can be rigorously justified.

The chapters on vector representation, vector algebra and he multiplication of vectors, will give the student a good idea of the theoretical outfit of many electrical engineers, and will enable him to understand many published papers.

The second definition of self-induction given on p. 82, and the reference to Maxwell, are misleading. Clerk Maxwell's inferred definition is rigorous, and is the one that we have always used, not without success, to calculate the self-inductance of a coil. He defines it as that length which multiplied by half the square of the current in the coil gives the electromagnetic energy, due to that current, stored up in the field. We cannot understand what the authors mean when they say, on p. 83, that Maxwell's coefficient is a complex quantity. We are therefore at a loss to understand the greater convenience of the coefficient used by electrical engineers, which is stated to be a real quantity. The reviewer has used the electrical engineer's coefficient, but he has always had his doubts as to its reality. He has, however, no doubts about the reality of Maxwell's coefficients of self and mutual induction. He has spent several months calculating them and verifying them experimentally. He has also verified experimentally Maxwell's transformer formulæ (correcting an obvious misprint) which appear on page 475 of the *Phil. Trans.* for 1865. He tests the engineering formulæ, therefore, by the simple method of supposing the permeability of the iron of the transformer to be constant. If they simplify in this case to Maxwell's formulæ then they are deserving of closer study; but if not, then so much the worse for the engineers' formulæ.

In further chapters the theory of transformers, induction motors and commutator motors is given, and a good chapter on locus diagrams concludes the volume.—A. R.

Alloys (non-ferrous). By A. Humboldt Sexton, F.I.C., F.C.S., &c. Manchester: The Scientific Publishing Co. Price 7s. 6d. net.

It is stated in the preface that the author's object has been "to indicate the direction in which research is going on, and to give the maker and user of alloys such information as may be of practical utility, and will enable him clearly to understand the current literature of the subject, and to see in what direction he must look for further developments that may be of use to him." It must be understood that this is no book of recipes for the manufacture of alloys; rather it is a book which presents, within one cover, sufficient matter to awaken the interest of the student, who has already received a sound general training in chemistry and the allied sciences, and, on the other hand, may serve to indicate to the maker and user of alloys what assistance in his business he can expect from the scientific control of his processes. All the same, the book contains much information of directly technical value, as, for example, in the account of the influence of small amounts of impurities, or of deliberately added metals, on the tensile strength and extensibility of the brasses, in Chapter VII.

Having discussed, in the introductory chapter, the nature of alloys, and reached the conclusion that, whilst a few, such as those of bismuth and tin, are true chemical compounds, in the great majority of cases we have to deal with a solid solution of two or more metals in each other, Prof. Sexton proceeds to the consideration of the methods of investigation which have been applied to most of the important series of alloys.

Chapters II and III deal with the physical properties of the alloys as related to those of their constituents, and with the phenomena of solidification, the latter containing interesting discussions of the conditions under which an homogeneous alloy may be obtained, of the phenomena of the evolution of gases from cast metals, and of the methods by which the consequent difficulties may be surmounted.

In Chapter IV, Prof. Sexton describes the preparation, by polishing and etching, of samples of metal for microscopical examination, and, with the aid of excellent reproductions of microphotographs, explains the information, which may be thus obtained, as to the structure of alloys. The properties of an alloy can be understood only in the light of a knowledge of its structure, and it is possible only by micrographical examination to observe a change in the structure, and therefore to understand a change in the properties, which may have resulted from some slight modification in

the method of preparation or in the subsequent treatment of an alloy.

Chapter V, which deals with the changes which may take place in the structure of alloys in the solid condition, is interesting from a practical point of view, as showing how necessary is correct heating if good results are to be obtained in annealing. The strength of an alloy is determined to a great extent by the coarseness or fineness of its crystalline structure, and this depends on the temperature to which the alloy is heated, on the duration of the heating, and on the rate of subsequent cooling. The importance of these conditions is often not realised, which makes it possible for the author to write "there is probably no operation in which failures are more frequent." And yet annealing is considered a simple operation! The microphotographs in this chapter, of brass after heating to various temperatures between 500° and 1,000°, are very instructive.

After a chapter dealing with the properties of the metals in common use in the preparation of alloys, we come to a series of chapters, VII-XIV, devoted to an account of the results which have been obtained by applying to the different groups of alloys the methods of investigation already described. These chapters are well illustrated with curves and reproductions of microphotographs. Here are to be found striking examples of the relation between the physical properties of an alloy and, on the one hand, its chemical composition, and on the other, the treatment which it has undergone. In this connection special attention may be drawn to the table and curves for aluminium bronzes on pages 158-162.

The maker of alloys may, perhaps, find the last chapter the most directly useful, if not the most suggestive. Here, in some 40 pages, Prof. Sexton gives us a succinct account of the methods employed in the preparation of alloys. This chapter, like the rest of the book, is well up to date, and includes descriptions and illustrations of the furnaces in technical use at the present time.

The book is well worth the attention of all interested in the manufacture and use of alloys.

The Construction of Underground Telegraph and Telephone Lines. Post Office Telegraphs (Engineering Department). London: Wymans. Edinburgh: Oliver & Boyd. Dublin: Ponsonby. Price 1s. 6d. net.

The book which we have now before us is an official instruction issued by the Post Office authorities purely for the guidance of their own officers. It is, therefore, not by any means a publication in the nature of a text-book on the subject; it is far more, inasmuch as it comprises, in very concise form, a mass of information based upon practical experience derived by the Department's staff, spread over a number of years, during which this special class of engineering work has developed into what one might almost refer to as something approaching an exact science—using the term rather loosely. Indeed, one feels, after a rapid and cursory glance through the pages of the instruction, that that which consisted mainly of the application of a little rule of thumb knowledge in the laying down of a few pipes and hauling through them a few gutta-percha-covered wires has now, with the lapse of time and with the rapid growth of underground telephone systems in towns and cities, grown up, matured, and become an important branch of the profession of what is termed civil engineering. In fact, it seems that the laying down of telegraph and telephone mains is somewhat akin, although on a smaller scale, to the construction of a railway line.

We observe in the opening chapters very detailed instructions, of general utility, which deal with, *inter alia*, survey and choice of routes, descriptions of several classes of pipes and ducts, with information as to their manufacture, instructions as to jointing, avoidance of obstacles, damage to property, and strength of materials. There is also some information showing the system adopted by the Department for recording the position of underground mains. (This last, in view of recent discussions, will no doubt interest many municipal lighting and tramway engineers.) Following this comes information as to the construction of many types of manholes, jointing chambers, test pillars, &c., with chapters on the bonding of pipe lines for the preservation of their electrical continuity and tests for the efficiency of the same; all of which information should prove distinctly useful to any engineers who have to do with matters beneath the surface of the road.

The following section of the book deals with special matters relating to cables, with descriptions of methods and devices for jointing adopted for multiple wire cables. After this some pages are devoted to testing and testing apparatus, faults, repairs, and maintenance, in connection with which references are made to precautionary measures to prevent accidents from explosions or the presence of foul air, which, as experience has doubtless shown, are more or less to be anticipated. The next pages deal with descriptions of special appliances and tools, with instructions for their use; these include a description of a portable petrol-driven air compressor and a novel gas leak indicator. The final pages contain appendices in the way of schedules of materials, tools and plant, cables, speech transmission equivalents for various gauges of conductor, and grouping of multiple ducts.

The book is liberally illustrated by reproductions of photographs, drawings, and diagrams. In fact, every detail referred to in the text appears to have its corresponding illustration.

The whole has probably been subjected to a careful checking, counter-checking, sub-editing, and editing to an unknown degree, so that there is but little left for the reviewer upon which to base any of the usual criticisms. He has, therefore, to content himself with merely indicating as briefly as may be its scope and contents, recommending its perusal to all engineers at home or abroad, who have, or may have, anything to do with such or similar works. The Engineer-in-Chief's department is to be congratulated upon the addition of another number to the existing series of valuable instructions, whilst the Post Office authorities are to be much commended for allowing the same to be placed at a reasonable price within the reach of the general public.—R. M. H.

Some Electrochemical Centres. By J. N. Pring. Economic Series, No. 10. Garside Reports on Industry and Commerce, No. 7. Manchester: Manchester University Press, 1908. Price 1s. 6d. net.

The Garside Scholarships were established in 1902 by Mr. J. H. Garside, of Manchester. The conditions of tenure are that each scholar shall enter the University of Manchester for one session, the remainder of the time covered by the scholarship being occupied in an examination of commerce and industry in certain Continental countries and America. The results of these investigations are given in a series of reports, of which the present one is of interest chiefly to students of applied electricity. Although this small volume throws no new light on the progress of the electrochemical industry, a special value attaches to it, in so far as the information acquired is based mainly on personal knowledge. Accuracy, therefore, as the word "report" implies, is one of the outstanding features of the book. As the author states in his preface, the majority of electrochemical works are still more or less in an experimental state, and the details of the processes are usually held in strict secrecy, so that admittance to the works is very difficult, and often quite impossible to obtain by outsiders. This statement might have been made much stronger, even with a process which has passed beyond the experimental stage, and become public property. Further than this, these industries have sprung up in widely scattered centres, which makes a comprehensive survey of the subject a matter of much difficulty. Bearing these facts in mind, the author has been remarkably successful, and has presented a really valuable report, the price of which cannot be considered excessive. After a short introduction, the author discusses the cost of power production, which, in many industries, when coupled with the cost of distribution, is the first factor of importance. The charges in various electrical centres are given along with other useful information. The chief electro-

chemical centre of the world—Niagara—is dealt with at some length in Chapter II. This includes the cost of power and details of the production of various electrochemical products, such as carborundum, graphite, &c. In Chapter IV the water-power of Canada is dealt with at some length. In some specially favoured centres this has been developed or schemes are under consideration, but it will surprise most people to learn of the enormous amount of wasted energy in this portion of the British Empire. It is from this favoured corner of the world that future industrial development is to be looked for. Copper refining and electric steel production also receive a fair share of attention. Ozone and water purification is dealt with in Chapter VI, the three successful processes now in use being described. Bullion refining, the manufacture of carbon bisulphide and the fixation of atmospheric nitrogen are all considered. The electrochemical industries of the Alps, France and Belgium, and, finally, the power centres and electrochemical works of Great Britain, are given space in this report. From end to end, the book is extremely well written, and is entirely free from the so-called printers' errors. The descriptions of the various plants are clear and concise, on the whole, but might have been given in greater detail in a few cases, as in that of the ozone plant. This is a small point, but an important one, as the number of readers fully acquainted with all electrochemical developments is rather small. Beyond this, no serious criticism is offered, and the most sincere congratulations are tendered to the author for this extremely useful and comprehensive report.

Electric Furnaces. By WILHELM BORCHERS, translated by H. G. SOLOMON. London: Longmans, Green & Co. Price 7s. 6d. net.

The present volume is translated from the second edition of "Die Elektrischen Ofen," by Dr. Borchers. An attempt has been made, however, to cope with the recent rapid progress in electric furnace work by including an appendix, wherein two new furnaces are described. The method of treatment and classification adopted is the only rational one possible, *i.e.*, from the point of view of the heating system employed. In this manner the text naturally falls into sections, each occupying a chapter. The first chapter is introductory, and might well have been omitted. This occupies four pages, without giving any information more advanced than that in an elementary text-book of electricity. After this preliminary canter the author passes on to the serious business of the book. Chapter II deals with direct resistance furnaces. The matter is developed historically, commencing with the early experiments of Davy and Pepys. The pioneer work of Cowles is described in some detail, and the development of modern resistance furnaces is brought up to date to about the end of 1905, or the beginning of 1906. In his endeavour to include everything, the author has become extremely uninteresting to read. Furnace after furnace is described, with innumerable diagrams. Many of these are unnecessary in a text-book of this class, and this is especially the case with the figures. Here two, or even three, views of one plant are given, very often in the case of a furnace which is not in commercial use. Another point is very apparent, not only in this chapter, but all through the book, viz., the very large number of modified furnaces to which the author attaches his name. There is a want of clearness in many places which is extremely annoying to the reader. Another vexatious point, which might have been changed by the translator, is that of the alteration of the basis of estimated yields. Thus, on page 59, in connection with trials on a Kjellin furnace the yield of output is first given in kilogrammes and tons per 225 E.H.P., and in the next lines for an improved furnace the output is in pounds and kilogrammes per H.P. This is a minor blemish, but it does not add to the interest of the book. Chapter III embraces indirect resistance furnaces which, of course, include Acheson's carborundum and graphite furnaces. Kryptol furnaces fall into this class, and no fewer than five types to which the name of Borchers is attached. Diagrams are again very numerous, and not too accurate. For example, the plan and elevation on page 81 do not fit each other. In Chapter IV direct arc heating is dealt with in a very exhaustive manner. Four pages of text are justly devoted to the Siemens arc furnace, which, in spite of its failure from a commercial point of view, defines the period of successful furnace work. Many difficulties were recognised and overcome in this venture, and failure was due, chiefly, to the fact that the inventor was a few years in advance of his time. Chapters V and VI deal with the arc type of furnace, and bring the subject practically up to date. Naturally, the Stassano furnace is described in detail, but it is noticeable that the latest form of rotating plant is not touched upon. In the next chapter general considerations of furnace structure receive attention. The matter in hand is thoroughly and exhaustively handled. The author evidently means this to be one of the features of his book, and in this section the numerous diagrams are by no means superfluous. Many novel forms of electrodes are described. Various electrode holders—both in use and suggested—receive the attention they deserve. Cooling devices are discussed, and many other small but essential details are treated in a very able manner. Chapter IX is short, and merely pushes the well-known claims of superiority of the electric type over the older furnaces. In the last chapter furnace outputs are dealt with for a few well-known cases.

This book is a distinct advance on anything previously published. In many respects it is too ambitious, and it is quite impossible to be thoroughly exhaustive in 224 pages. Consequently, many useful data are omitted, and a few novel types of furnaces are not even mentioned, but, on the other hand, much attention is given to plants which could not possibly come into commercial use. One feature in particular deserves attention, and this is the freedom from errors usually set down to the printer's negligence. In fact, the whole book has been prepared very carefully by both translator and publisher. Without hesitation, the book can be recommended to all interested in the evolution of applied electricity. If not perfect, it is at least far in advance of anything else in its class.

The Cultivation and Preparation of Para Rubber. By W. H. JOHNSON, F.L.S. London: Crosby Lockwood and Son. 1909. Price 7s. 6d. net.

This is the second edition of Mr. Johnson's book, and it is stated to be rewritten and greatly enlarged. In the preface the author says that "it includes all the latest authentic information and covers a far larger range of subjects likely to be of interest or utility to those in any way connected with the rubber industry." This is a large programme for so small a work. It would, perhaps, have been better if the author had confined himself to dealing with matters which are of interest to the planter, investor and botanist, as it is to these that this work will appeal, for the pages dealing with the technical processes to which crude rubber is subjected after it reaches the factory, and with the chemistry and physics, are somewhat superficial, not to say scrappy, and can scarcely be of much practical value either to the manufacturer or to the user of rubber articles. In this respect it is only fair to say that Mr. Johnson's work possesses the fault of a very large proportion of books dealing with technical subjects, in that they say either too much or too little.

We cannot agree with Mr. Johnson's statement that "it (india-rubber) was not, however, employed extensively in commerce until after 1874, when the method of vulcanising rubber, by heating and treating it with sulphur, was discovered." Hot vulcanising was discovered by Goodyear in 1839, and subsequently, independently, by Hancock about 1842. Cold curing was discovered by Parkes in 1846. As a matter of fact, the table on page 2 shows that, in 1870, the importation of rubber into the United Kingdom was roughly 25 per cent. of the quantity imported at the present day.

Chapter II, which is on "The World's Production and Consumption of Rubber" is of considerable interest, although the figures referring to the future development of the plantation industry must be regarded as being of a somewhat speculative nature. Chapters III and IV are on the "Para Rubber Trade at Home and Abroad," and "Propagation" respectively, and Chapter V deals with "Planting and Cultivating." Chapter VI deals with "Soils and Manures"; Mr. Johnston correctly states "that the investigation of

various soils in which Para rubber trees have been successfully cultivated tends to show that it is not fastidious in regard to its requirements in this respect," and it is well that this is so, for it is doubtful whether, in most cases, artificial manures could be economically employed, although one rather gathers from Mr. Johnson that this is a somewhat ordinary operation.

Chapter VII contains a carefully written description of the various fungus and insect pests by which the trees may be attacked. It should be of practical use to the planter. Chapter VIII, on "Latex," and Chapter IX, on "Collecting the Latex," are of interest, although the former, in view of much recent published work, might have been somewhat fuller.

Chapter X, on "Rubber Manufacture," as we have indicated, leaves a good deal to be desired, and certainly that part which deals with chemistry, with physical properties and with manufacture proper, might well have been omitted. The part of this chapter dealing with the preparation of rubber from the latex would have been of more value if it had been written in a more critical spirit. Nevertheless, it contains a number of interesting illustrations of machinery of the latest type for preparing the crude rubber, and the plans of factories designed for this purpose are very fair representations of this class of work. Chapter XI is on the "Antisepticisation of Rubber," and Chapter XII contains much of general interest with regard to the "drying and packing of rubber for export." Chapter XIII is on the "Yield of Para Rubber from Cultivated Trees," and contains a number of highly-interesting tables in which statistics of production in this regard are recorded.

To the investor, there is much in Chapter XIV (on the "Establishment and Maintenance of a Para-Rubber Plantation") that is well worth reading, but it is, perhaps, desirable to point out that most of the figures are based on estimates dating back a number of years, and some of them are decidedly, in our opinion, too low, while others have, in the light of a more mature knowledge, been amply confirmed. There can be no doubt that the industry of rubber planting is one of the most valuable commercial assets of the British Empire.

DETERMINING THE AMOUNT OF INJECTION WATER REQUIRED TO CONDENSE EXHAUST STEAM.

By A. W. EMPSON.

Various formulæ have been given for finding the amount of cooling water required by a jet condenser per lb. of steam, but the results obtained are all, more or less, approximate, as the amount of water in the exhaust steam varies considerably, and this is only one source of inaccuracy.

In cases where it is possible to meter the injection water, and the discharge from the air pumps, there is no difficulty, but such conditions do not often exist, and recourse is then had to empirical formulæ.

Some time ago the writer devised a chemical method of ascertaining the ratio between injection water and steam, which he believes to be original, and which he has found to be susceptible of great accuracy.

The principle of this method consists of measuring some constituent of the injection water which is stable under the influence of such heat as would be applied to it in the process of condensation. The amount of the same substance in the air-pump discharge water is then measured, and will, of course, be less in proportion to the extent to which the injection water has been diluted by the condensed steam.

In several cases where this method was tried, the injection water was found to contain a certain amount of chlorine, combined with sodium as common salt, and this, being very stable, was selected as the most suitable substance upon which to base the tests.

The element chlorine is very easily estimated by means of a solution of silver nitrate. When silver nitrate is added to a solution of a chloride, the chlorine combines with the silver to form silver chloride, the reaction being, in the case of common salt :—

$$\underset{\text{Sodium chloride}}{NaCl} + \underset{\text{silver nitrate}}{AgNO_3} = \underset{\text{silver chloride}}{AgCl} + \underset{\text{sodium nitrate}}{NaNO_3}$$

The silver chloride appears as a milky precipitate, which will not dissolve on the addition of nitric acid, and this forms a sure test for the presence of chlorine.

In order to show the exact point at which the formation of silver chloride ceases on the addition of silver nitrate, a solution of potassium chromate is used as indicator.

Potassium chromate (K_2CrO_4) combines with silver nitrate and forms a precipitate of silver chromate, the colour of which is red, but so long as any chlorine is present uncombined with the silver nitrate, the silver nitrate will continue to combine with it in preference to the potassium chromate ; the appearance of the red colour signifies that all the chlorine has combined with the silver.

The following apparatus is required for the test, the approximate cost being given in brackets :—

One white glazed porcelain basin about 8 in. in diameter and 2 in. deep (2s.).

One Mohr's burette with stopcock to hold 10 or 20 cubic centimetres graduated in tenths of a c.c. (10 c.c. 1s. 10d., 20 c.c. 2s. 2d.).

One wood burette stand with single clamp (1s. 9d.).

One thin glass stirring rod about $\frac{1}{4}$ in. diameter and 6 in. long (2d.) ; one 250-c.c. flask graduated at one mark on neck (9d.).

The solutions required do not, as in volumetric analysis, need to be of any exact strength, as the actual amount of chlorine need not be ascertained, all that is wanted being the ratio between the amount of chlorine in the injection water and that in the discharge from the air pump.

To make the silver solution, dissolve 4·5 grams of pure recrystallised silver nitrate (2s. per oz.) in 1,000 cb. centimetres of distilled water.

For the indicating solution dissolve 5 grams of pure potassium chromate (2d. per oz.) in 100 c.c. of water, and then add a few drops of silver nitrate solution until a slight red precipitate is formed, after which decant off the clear solution into a clean bottle and reject the precipitate.

Both these solutions should be kept in stoppered bottles in a dark place, and under such conditions will remain good for months.

In order to make a test, samples should be taken simultaneously from the injection water supply, and the air-pump discharge, and the latter should be allowed to cool down until both are at about the same temperature.

All the apparatus should be perfectly clean, and should be washed with distilled water before use.

The burette should then be rinsed out with a few c.c. of the silver solution, and filled up above the zero mark, the excess being run off through the tap until the bottom of the meniscus (*i.e.*, the curved surface of the liquid caused by capillary attraction) is level with the zero mark. All readings of both burette and measuring flask should be made from the bottom of the meniscus.

250 c.c. of one of the samples should be measured in the flask, and poured into the porcelain basin, taking care to rinse the flask *first* with some of the water to be tested, and after pouring out the measured quantity, to rinse with distilled, the latter being then added to the contents of the basin.

The reason for this is obvious, as it eliminates the error due to water clinging to the surface of the flask.

Six drops of potassium chromate solution are then added, and silver nitrate solution is run in from the burette, a few drops at a time, with constant stirring, until the colour of the water changes to a permanent faint red. Note the number of c.c. of silver solution used, and then follow the same procedure with the other sample until the same tint is obtained as in the previous test.

The results are worked out as follows :—

Supposing the injection water requires 6·3 c.c. of silver solution, and the hot-well water 6·0 c.c., the ratio is then 63 : 60, and it will be seen that 100 lb. of injection water contains as much chlorine as 105 lb. of hot-well water (60 : 63 = 100 : 105), therefore every 100 lb. of injection water has been diluted by 5 lb. of condensed steam, and this

gives 20 lb. of injection water required to condense 1 lb. of steam.

Should any difficulty be experienced in judging the colour, two similar porcelain basins may be employed, and one sample, having been tested, should be placed near the second sample; the tint of the latter can then be more accurately matched to that of the first.

The same amount of water and potassium chromate should be used in each case.

Should the water be faintly acid, it should be brought to neutrality by the addition of sodium carbonate (free from chlorine), but this is very rarely necessary. Oil in the water in the form of emulsion has not been found to interfere with the test, even when present to the extent of 12 grains per gallon.

Failing chlorine in the water, the permanent hardness may be determined by any of the well-known methods, and from this a ratio can be obtained which can be worked out as above.

The foregoing instructions may, at first sight, appear somewhat formidable, but the process is really very simple and easily performed, and the writer hopes it may be of service to many engineers who have not facilities for measuring by means of calibrated orifices or weirs.

PROCEEDINGS OF INSTITUTIONS.

The Electrical Operation of Textile Factories.

By Herbert W. Wilson.

(*Abstract of paper read at the Summer Meeting of the* Institution of Mechanical Engineers *at Liverpool.*)

The claims put forward by those in favour of electrical driving may in tabular form be stated as follows:—

1. The mill and engine house can be placed each in its most convenient position without regard to their relative situations.
2. The internal arrangements of the mill as regards shafting, gearing, belt and rope drives, &c., are much simplified and the cost reduced. The flexibility as to extensions is, of course, obvious.
3. The grouping of the machines is much less arbitrary than in an ordinary mill, as the motors and light shafting required can be placed where most convenient.
4. The reduction of the chance of a breakdown which would stop the whole mill.
5. The ease with which sections of the machinery can be either stopped or run overtime (where conditions permit) without waste of power.
6. The reduction in the maintenance and depreciation charges.
7. The reduction in the capital cost per loom or per spindle of the whole factory when once a given size is exceeded. This is partly due to reduction in the weight and cost of the buildings.
8. The possibility of obtaining records of the work done in the different sections of the factory, otherwise impossible, and the keeping of a constant check upon them.
9. The greater steadiness of drive which can be obtained with a consequent permissible higher average speed and increased output.

The last claim is by far the most important one. It has been proved to all reasonable satisfaction in many cases, that electrically-driven spindles in a mill can be run at a higher average speed, on the same counts, than mechanically-driven ones, with a corresponding higher production, and this can only be accounted for by the fact that the electrically-driven spindles run more steadily.

In an electrically-driven factory, properly laid out, the speed of every machine should correspond directly with the speed of the prime mover, and, given satisfactory regulation on the engine, every producing machine can be speeded up to its safe maximum and kept there. With even the best rope transmission it has been found in a number of cases in Lancashire mills that the speed of the machines closest to the driving point is steadier and higher than that of the machines furthest away. In other words, the one machine will give a larger output than the other. This has been tested by several persons in different factories quite independently, and the general order of the results has been the same. In one fairly well-known case in Lancashire, with two mills under the same management and of about the same size and working under the same general conditions, the results obtained from the electrically-driven factory have been distinctly superior to those from the mechanically-driven one. To such a marked extent was the improvement in quality of yarn noticeable, that the output of the electrically-driven mill fetched a distinctly better price than that from the other factory, the increase being stated at about 2½ per cent.

It is exceedingly difficult to get absolutely reliable statistics concerning the improvement in output and quality obtained by mills in this country, which have adopted electrical driving, but it may be taken as a conservative estimate that the increase in production is on the average at least 5 per cent.

Considering Lancashire practice, the cotton spinners and weavers state their costs at so much per pound of yarn or cloth produced. In the case of a spinning mill on most classes of counts, it may be taken that the margin over the price of raw cotton, out of which the manufacturer has to pay all his costs and make his profit, is something like 3d. to 3⅜d. per lb.

Assuming a price of 4d. per lb., therefore, the selling price of the yarn would be, say, 7½d. A considerable portion of this 3½d. is made up of the piecework price per pound paid to the operatives.

Assuming, however, that the fixed charges amount to 12 per cent. of the total costs, which is a fairly average figure, an increase in output of 5 per cent. would mean a reduction in cost per pound on the whole output of 0·6 per cent. In a modern spinning mill the total power costs do not amount to more than 2½ per cent. to 3 per cent. of the total expenses, and an increase of 10 per cent. in the cost of power would only mean an addition of 0·25 per cent. to the cost per pound of production. It will be seen, therefore, that even allowing for a considerable increase in the cost of power, which personally the author does not admit, there is a margin of 0·35 per cent. extra profit on the whole turnover, which means a considerable amount in a year.

As regards capital cost, taking a new spinning factory as a basis, and assuming that if electrically operated, the structure would be brightened and modified to suit the altered conditions, then below 80,000 mill spindles the mechanical transmission system is the cheaper, between 80,000 and 100,000 the costs are about equal, and above 100,000 the electrical system is the cheaper. The efficiency of the electrical transmission system would be about 82 per cent. to 83 per cent., or about the same as a well laid-out modern mechanical transmission system.

In the case of an old factory requiring re-equipment, it frequently happens that owing to the inconvenient arrangement of the existing buildings the electric drive offers distinct advantages as regards both initial capital outlay and efficiency. Cases have come before the author where the conversion has resulted in a reduction of 20 per cent. of the power consumption.

The intermediate case of a fairly modern factory with a good mechanical transmission system requiring extensions above the capacity of the engine, is a very interesting and promising one. Under such circumstances as these the use of the exhaust steam turbine has many advantages, and, as will be shown, this almost of necessity involves, either wholly or partially, the electrical driving of the factory.

To take a concrete case now under consideration. A spinning mill mechanically driven but electrically lighted, has a main engine of the compound vertical type developing 1,000 I.H.P. with a steam consumption of about 13 lb. per I.H.P.-hour. The lighting dynamos are driven by the main engine, and in the winter when fully loaded require a trifle over 100 H.P.

It is required to make some extensions in the factory involving an additional load of about 200 H.P. It was first suggested that a generating set of 150 KW. (225 I.H.P.) should be installed, but as plenty of condensing water is available, it has been found possible to alter slightly the valve-setting of the main engine, and obtain about 850 I.H.P. from it non-condensing and 500 I.H.P. from an exhaust steam turbine utilising the steam from the engine. In this manner it would be possible to obtain some 1,350 I.H.P. for a steam consumption of about 10·5 lb. per I.H.P.-hour. The saving in fuel over the other arrangement suggested is approximately 30 per cent., and this with the comparatively high price of coal in the district under consideration makes the total saving a large one.

This brief statement of a comparatively common case shows how in existing factories the introduction of the electric drive may reduce working costs, apart altogether from every other advantage.

The result of the author's observations is that a Lancashire factory of, say, 1,500 I.H.P. capacity, can produce energy at, say, 0·2d. per I.H.P.-hour, or 0·3d. per KW.-hour, allowing for interest and depreciation. This is on a basis of being able to purchase good slack with a calorific value of 11,000 B.TH.U. at 8s. per ton delivered.

It has been found generally practicable to induce fairly large factories to purchase power at about 0·4d. per unit net, metered on the low-tension side of the mill switchboard.

The main differences of opinion among engineers designing the lay-out of electrically-equipped mills arise over the questions of group or individual driving. The more nearly the ideal of a motor to every machine can be approached the better the actual results, but the higher the capital outlay and generally the running cost. The author is in favour of the individual driving of ring spinning-frames, and the group driving of all other machines, keeping the groups fairly small. It is absolutely essential that the arrangement of the motors shall have very careful consideration.

A point needing attention is the heating effect of the motors. It is now the best practice to build them with hollow frames, and to bring cooling air from some external source round the frames, thus preventing the discharge of heat to the room.

It is by no means a safe rule to assume that the horse-power is so much per 100 spindles of the mill, as this may lead to considerable error. The most careful consideration of the power taken by each section of the installation is necessary.

Some figures from mills actually working near Manchester may be of interest. In Table I is given a list of machines installed in a small mule-spinning mill, with a statement of the horse-power required by the various machines, calculated on the usual basis.

In Table II is given a more accurate statement of the power required per machine, or the average number of spindles per horse-power, the speed of running of the machine, and the nature of the load provided by the machine, including also an estimate of the time the machine is standing idle for doffing, shown as a percentage of the total running time.

In Tables III and IV are given the sizes of motors actually

installed in two mills in Lancashire where group-driving is employed, and it may be said that in nearly all cases these motors are direct coupled to high-speed line shafts. It must be remembered that in all these cases the *average* number of spindles per horse-power is stated, and this may vary considerably with the speed of the spindle and class of counts spun.

In the case of ring frames the number of spindles per horse-power may vary between 140 at 6,000 R.P.M., and 80 at 9,000 R.P.M., so that great care has to be exercised in considering the question of the size of motors required.

TABLE I.

1 Bale breaker and lattice mixing arrangement	3 H.P.
3 Horizontal exhaust openers	18 H.P.
10 Single scutchers	35 H.P.
84 Carding engines...	84 H.P.
11 Draw frames	20 H.P.
9 Slubbers, total spindles 882	17 H.P.
16 Intermediates, total spindles 2,212	36 H.P.
40 Rovers, total spindles 6,880	100 H.P.
28 Mules, 1½-in. gauge, total spindles 36,063 ...	314 H.P.
40 Mules, 1½-in. " " "	242 H.P.
Total	869 H.P.

TABLE II.

Machines.	H.P. approx.	R.P.M.	Load and loss of time.
Hopper bale-breaker	3	300	Steady if feed is regular
Hopper feeder ...	1½	600	"
Exhaust opener ...	6-8	850-1,000	"
Single scutcher ...	3½-5½	950-1,400	"
Carding engine ...	1	950-1,400	Steady
Drawing frame ...	0·15 per delivery	140-190	"
Slubbing frame ...	45 sps. per H.P.	180-300	8-27·5 % loss; load steady during run
Intermediate frame	55 sps. per H.P.	200-4 0	39-22 % "
Roving frame ...	65 sps. per H.P.	360 490	18-8 % "
Ring frame... ...	70 sps. per H.P.	360-480	17-5 % "
Mules	100 sps. per H.P.	600-1,000	5-10 % "
Doubling frame ...	40-70 sps. per H.P.	—	4-7½ % loss; load very variable
Winding	300 sps.	600-1,000	5-10 % loss; steady during run
Beaming	6 per H.P.	140-180	Steady
Sizing machine ...	1½-3	40	"
		210-300	"

TABLE III.

Machines.	Size of motors.
Bale breakers, exhaust openers, lattice mixers, scutchers ...	45 H.P., 575 R.P.M., directly connected to line shaft.
20 carding engines, 3 draw frames, 3 slubbers and 6 intermediate	55 H.P., 575 R.P.M., driving counter-shaft with ropes.
3 pairs of mules and 14 rovers ...	100 H.P., 580 R.P.M.
6 pairs of mules	130 H.P., 530 R.P.M.
4 pairs of mules and several ring frames	100 H.P., 580 R.P.M.
120 looms	50 H.P., 580 R.P.M.
153 looms	65 H.P., 580 R.P.M.

TABLE IV.

Machines.	Driven by
2 waste pickers	1 motor, 12 H.P.
1 roving waste-opener	
2 hopper bale-breakers with lattice mixers	
4 hopper feeders...	2 motors, 40 H.P. each.
4 horizontal openers with double scutchers	
12 single scutchers	
84 cards, 45-in. cylinder.. ...	2 motors, 65 and 50 H.P.
3 drawing frames, each 6 heads of 7 deliveries each	
8 slubbing frames, 100 spindles	2 motors, 90 and 75 H.P.
19 intermediates, each 146 spindles	
45 rovers, each 184 spindles ...	
63 ring frames, 2½-in. gauge 6-in. lift. Total spindles, 34,864	Several motors aggregating 850 H.P.; in 200-H.P. and 150-H.P. units.
32 mules, 1½-in. gauge. Total spindles, 41,216	
3 winders, 2,000 spindles ...	15 H.P.
10 beaming engines	Approximate total = 1,250 H.P.

Owing to want of time, the discussion on the papers "Advance of Marine Engineering" (briefly abstracted in "Notes" in our last issue) and "Electrical Operation of Textile Factories" was confined to a comparatively short period, and, in the majority of cases, the observations were submitted in writing.

MR. W. SISSON, of Gloucester, referred to a paper read by Mr. Durtnall on electric power for main marine propulsion, and said that the application of main electric drive for working screw propellers was very promising.

In the discussion of Mr. Wilson's paper, MR. MARK SUTTON, of Rio de Janeiro, Brazil, spoke of the electric installation of his two mills. He was in favour of group driving, and he had had excellent results from the motors, which had been running for about seven months.

MR. A. SAXON, of Manchester, thought Mr. Wilson ought to have selected a better case for comparison than the two Lancashire mills he had mentioned, one having been built in 1855 and the other, electrically driven, about 1905. Under such conditions, it was hardly to be wondered at that the electrically driven mill had an increase of 2½ per cent. in price of output.

MR. CORTEY LEIGH said it was true that in the Bannerman Mills a comparison was made between the two drives, but it was made with up-to-date steam engines, and, after the points had been closely considered, Mr. C. Macara decided in favour of the electric drive, which was more efficient and cheaper.

MR. WILSON, replying to the points raised, said the old building referred to by Mr. Saxon was re-equipped with the mechanical transmission system 12 or 13 years ago. As to the Bannerman Mills, Mr. Macara had concluded that the installation of the electric drive meant at least a 5 per cent. increase in production, and he had satisfied himself that that increase was being obtained.

Some Tests and Uses of Condensers.

By W. M. MORDEY, President I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *in London, May 20th*, 1909.)

THERE was a period when the capacity of the cables in distribution systems in many cases provided a good deal of compensation for self-induction. But now the growth of the motor load is making a difference, and in many cases there is a real need for the improvement of the power-factor in supply systems, for various reasons, such as keeping down the loss in the mains and increasing the useful output of generators and reducing their cost. The loss in the mains is inversely proportional to the square of the power-factor, thus:—

Power-factor ...	1	0·9	0·8	0·7	0.6	0.5
Loss	1	1·24	1·56	2·04	2·78	4·0

As to the effect on cost and output, Mr. Miles Walker recently cited one case where the rating of some turbo-alternators was raised 50 per cent. owing to their being used at nearly unity power-factor.

For the improvement of power-factor the use of over-excited synchronous motors, originally described by the author in 1893, is practically the only method that has so far obtained engineering recognition. Mr. Fedden, of Sheffield, has installed a specially designed motor made by the British Thomson-Houston Co. It has a capacity of 600 K.V.A., and consists of a two-phase motor for 2,000 volts 50 cycles with a direct-current exciter and an induction motor for starting up, all on one shaft. It is used at intervals during the day to keep up the power-factor of the system and to reduce the excitation of the main turbine generators, which are in a station two miles away. At the present time the average day load is about 4,000 K.V.A., at an average power-factor of 0·7, equal to an actual load of 2,800 KW. The rectifier raises the power-factor to an average of 0·83, reducing the apparent load from 4,000 to 3,380 K.V.A., thus releasing 620 KW. of capacity in generators, and in cables between the two stations. These figures correspond to a load on the motor of nearly 1,000 K.V.A.

Of the many kinds of condensers only two types are here considered—the Mansbridge and Moscicki types.

The former have the great advantage that if they are pierced they are self-healing, but they appear, however, only to have been made for low pressures.

The Moscicki condensers are said to be largely used for wireless telegraphy, and they are being used in some cases abroad for power-factor improvement on extra-high-tension transmission lines. They seem to be very suitable for this purpose, as by the use of a suitable thickness of glass they can be made to withstand a very high voltage.

I have had some tests made of both types by Mr. Wild, of the Westminster Testing Laboratory. It is believed that the results may be relied upon for the low-tension paper condensers within 5 per cent. each way, and for the high-tension glass condensers within 7½ per cent. each way at the highest voltages and 15 per cent. at the lowest.

The results of the tests are shown in figs. 1 and 2 (p. 238).

The capacity and power-factor were found to be nearly constant at all frequencies. The variation of power-factor with voltage was less than the instrumental errors within the limits of the tests. It will be seen that the loss of energy was small.

It would seem that no difficulty should be met with in using a number of Mansbridge condensers in series for high-tension work, as the conditions in each section as to voltage, loss and power-factor, will be the same when used in such a series as when used singly. The British Insulated and Helsby Cables, Ltd., who made the condenser tested, have, in answer to the author's question, suggested 500 volts per section for a condenser so made up for 10,000 volts, and state that it would occupy about 2 cb. ft. per microfarad, and they think the price would be about £27 per microfarad. They, however, have had no experience of condensers so made up or used.

The Moscicki condenser tested consists of eight tubes, having a total capacity of 0·03 microfarad. It is intended for A.C. working at

10,000 volts. Each tube is 2 in. in diameter and 2 ft. 9 in. long, or with connections, 3 ft. 2 in.

Some tests were made of a set of six Leyden jars of ½-gallon size, having a total capacity of 0·015 microfarad, lent by Mr. Campbell Swinton.

At 5,000 and 7,500 volts the loss in watts per microfarad in the Moscicki condenser and in the Leyden jars is the same, but at 10,000 volts there is a marked difference. There is some brush discharge in the Leyden jars from 5,000 volts upwards. The losses in the Moscicki condenser continue to increase approximately as the square of the voltage. The curves showing variation of power factor with frequency must be accepted with some reserve; they show, however, that the Moscicki glass condenser works with a loss of about 1 per cent. of the kilovolt-amperes dealt with.

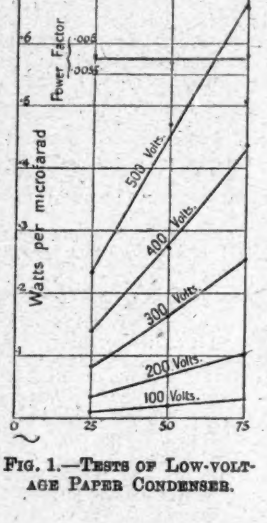


FIG. 1.—TESTS OF LOW-VOLTAGE PAPER CONDENSER.

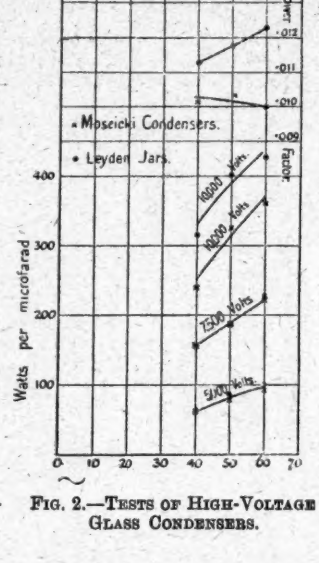


FIG. 2.—TESTS OF HIGH-VOLTAGE GLASS CONDENSERS.

The C^2R loss accounts only for an insignificant proportion of the total losses with alternate current.

From the results shown, a 10,000-volt Mansbridge condenser would lose about 190 watts per microfarad at 50 periods, and the Moscicki 10,000-volt condenser about 320 watts per microfarad; respectively about 0·6 per cent. and 1 per cent. of the kilovolt-amperes dealt with. These losses are of the same order as the magnetising losses in transformers of good design. With such small losses as these, no difficulty should be experienced in preventing objectionable heating.

Comparing condensers with over-excited synchronous motors, we will assume a synchronous motor or a condenser installed for the compensation of a circuit requiring 1,000 KW. at 10,000 volts, 50 periods, with a power factor of 0·8. To give unity power factor, this would need a motor of 750 K.V.A., or a condenser having a capacity of 24 microfarads.

The cost of the motor erected with foundations, switchgear and accessories will not be less than £1,100, and at a mean of 30 KW. for 12 hours a day, the total annual consumption will be 131,400 units.

The cost of a condenser of 24 microfarads for the above conditions would be about £720 with switchgear and accessories, and the loss not more than 7·5 KW. at full load. The condenser could be in sections, some of which would be switched out as the load fell, but we will assume that it is all kept in circuit for 12 hours a day. The total annual consumption would be 32,850 units.

Charging only the cost of the coal, say 0·25d. per unit, we get the following comparison:—

	Synchronous motor.	Condenser.
Capital cost	£1,100	£720
Annual cost of energy wasted ...	137	34·2

These figures speak for themselves. They would be still more striking if the comparison included necessary spare apparatus. Moreover, a large condenser could be sub-divided without disadvantage, but in the case of synchronous motors such sub-division would involve considerable increase of cost and loss.

No attempt has been made to compare the cost of condensers with the added cost necessary to make ordinary motors or rotary converters available for power factor correction in addition to their ordinary work, but the low capital and working cost of the condensers points to a comparison, even on this basis, being possibly favourable to the latter.

In conclusion, it may be of interest to give the result of some experiments on the use of condensers for preventing or stopping the formation of arcs under certain conditions. In investigating the action in a surface contact tramway system recently, the author found that trouble was experienced due to the formation of persistent arcs at the underground contacts. When the road was wet and dirty a small leakage current passed from the live contact stud under the car over the surface of the road to the rails. When the car had passed and the underground contact-piece had separated its proper distance from the live conductor, this leakage current was sufficient to maintain an arc across the air-space of the contact-maker, thus keeping the stud alive so long as the arc persisted. It was found that with a terminal voltage of about 560 volts the voltage between the stud and the rail was usually about 400 to 440 volts, and the voltage across the arc about 120 to 160 volts. Sometimes arcs would persist for a few seconds with not more than 0·6 ampere, and they would often persist when the leakage current was over 1 ampere—this latter condition, it will be seen, corresponds to a resistance of the leakage path from the stud to the rail of a maximum of 440 ohms.

The prevention of these arcs by increase of gap, or by other structural alterations was not found to be practicable, and it therefore remained to try to find some means for preventing their formation, or for immediately putting them out if they were formed. For this purpose experiments were made with a condenser, which was found to be quite effective.

Two conditions may be given:—

(A) A suitable condenser placed across the gap prevents any arc being formed, however small the gap—for example, it was not possible to maintain an arc across a gap of even $\frac{1}{64}$ in.

(B) If the arc is formed and it is then shunted by a suitable condenser it will at once go out.

The minimum safe capacity for these two cases was found to be as follows:—

Amperes.	Condition (A). Microfarads.	Condition (B). Microfarads.
1·5	1	2
2·0	2	4
2·5	3	6
3·0	4	8

It was found quite practicable to extinguish the arcs by shunting them by a condenser carried on the car, one terminal being connected to the collector or skate, the other to a small wire brush hanging down under the rear platform of the car, and making successive contacts with the studs.

It was also found that the arcs could be put out by placing the condenser in shunt across the leakage path instead of across the arc itself, or with two condensers in series across the resistance and the arc, with a middle connection to the junction between them.

It was not necessary that the condenser should be in a discharged condition, the arc being put out, whether the condenser when applied was discharged or charged to the full voltage of the circuit in which latter case the effect would be produced in whichever direction of polarity the condenser was applied.

The arcs could also be put out by a resistance shunt, but there are objections to that, and in any case it need not be examined here.

MR. MANSBRIDGE, in opening the discussion, said the Helsby Co. were making L.T. condensers by the thousand, but very few H.T. ones, and as it did not pay to put down special plant for the latter, the L.T. units were usually built up for H.T. purposes. There were obvious advantages in not having high pressures across the terminals of a condenser, and he preferred multiple units. The C^2R losses were partly due to the resistance of the electrodes, as at present the Mansbridge condenser was used almost entirely for telegraph and telephone purposes, and the quantity of tin was kept small; if used continuously for heavy currents, it would be necessary to use more tin or more electrodes. He thought that a decrease in thickness of wax in the condenser would probably lead to a decrease of dielectric loss.

MR. W. B. ESSON commented on the unreliability of condensers up to the present, due, he supposed, to their having been made entirely by instrument makers; the Moscicki condenser, however, was an engineering device, and he had seen one behaving satisfactorily under a prolonged test at 6,000 volts. The compensating motor had been used with success in the Kolar Goldfields transmissions, where trouble was caused through lagging currents.

MR. J. E. TAYLOR suggested that the Duddell thermo-ammeter was preferable to the wattmeter for measuring condenser losses.

MR. MORDEY, in replying, said that the total losses in the condenser were at present so small that he thought there was not much chance of improvement.

Institution of Electrical Engineers.

AT the special general meeting of members, associate members and associates, held on July 29th, the President, MR. W. M. MORDEY, made the following statement:—

We have now reached a very important stage in connection with our new building on the Victoria Embankment.

On June 30th, last year, at a special general meeting, authority was given for the purchase of the property for a sum of £50,000. This purchase was duly completed on June 1st this year, the purchase money being provided as follows:—

From the accumulated funds of the Institution	£24,000
From a mortgage on the building	26,000
	£50,000

Ever since the meeting of June 30th last year, the Council have been engaged on the consideration of various schemes for adapting the building to the purposes of the Institution, and they have finally decided that it will be in the best interests of the Institution to enlarge and improve the entrance hall, and to rebuild the theatre completely. Plans prepared by our architect, Mr. Percy Adams, have been considered, and finally, specifications have been issued

and tenders obtained for the work. The result is that an expenditure estimated at £18,000 is necessary to cover these alterations in the building, and the equipment and furnishing of the large library on the first floor, and of the parts of the building to be occupied by the Institution, including also the cost of a lift and various other matters necessary to adapt the whole of the other parts of the building to the requirements of our tenants, the Colleges of Physicians and Surgeons.

The new theatre will be a very handsome one, appreciably larger than that of the Institution of Civil Engineers, in which we have for so long had the great privilege of holding our meetings. The modified entrance hall will provide a very attractive and convenient means of access to the theatre, library, offices and public rooms.

The funds of the Institution would be sufficient for the purpose of the required expenditure if we sold the Tothill Street site at the price we gave for it, viz., £17,500—a price which, we are advised, is a low one. It is believed that, when the time is more favourable, we shall be able to dispose of the site at a profit. Meantime, we have arranged for a mortgage on the Tothill Street property of £11,500, and have securities available amounting to £4,000, making a total of £15,500. As already explained, the estimated expenditure is about £18,000, and adding for contingencies and margin £2,000, we require a total of £20,000. We are, therefore, short to the extent of about £4,500.

The sale of the Tothill Street site at cost price would, after paying off the mortgage, yield £6,000. To meet this expenditure of £4,500, and to justify the Council in putting before the members a recommendation to proceed with the proposed alterations, the past and present members of the Council have guaranteed the difference between the assets and the requirements, on the understanding that if they are called upon to make any payments under this guarantee they are to be repaid out of the funds of the Institution when available, either as a result of the sale of the Tothill Street property, or from contributions to the building fund, or otherwise.

Two resolutions are before you: the first is necessary to meet the wishes of the Economic Life Assurance Society, from whom we have borrowed a sum of £26,000 on the security of the new building; the second is a resolution approving the proposed expenditure.

The resolutions, of which we gave the substance in our issue of July 23rd, were then passed unanimously.

Death through Lightning, and Workmen's Insurance.—The question whether a workman killed by a stroke of lightning, while at work, can be regarded as having met his death owing to an accident during the course of his employment, has engaged the attention of the Court of Arbitration for Swabia and Neuburg. It appears that on July 13th, 1908, while engaged in plastering the passage inside a new dwelling a workman was killed by a flash of lightning, which struck the fireplace and passed through the house. The father of the workman applied to the Bavarian Builders' Friendly Society for payment of the funeral benefit, but this was refused on the ground that the requisite connection between the death and the work was lacking. The union based its refusal on the consideration that it is necessary to prove not only that the accident occurred at the place of work, but also that it was produced by the work, that is, that it was occasioned by a danger standing in close relation to the work. Against this decision the father appealed to the Court of Arbitration, which ordered the friendly society to pay to the applicant funeral benefit to the amount of £4 13s., and the incidental costs. The Court held that in any circumstances, bodily injury caused to an insured person by lightning while following employment must be recognised as an accident at work, irrespective of whether the lightning stroke occurs in the open or in a protected room, or whether the conditions determining the direction of the path of the lightning can or can no longer be recognised.

Professional Etiquette.—An Australian correspondent sends us "A Few Notes on Electricity," the product of a *soi-disant* "consulting engineer," who has commenced business there. These notes are apparently intended to inform the public, and incidentally to attract custom:—

"Now, I wish you to thoroughly understand that you can apply electricity to any purpose or person of the most delicate character or nature, without the slightest danger. You can use it to melt a piece of iron in a pair of seconds. Therefore you can form an idea of the wonderful and powerful substance we are handling. . . . .

"I wish to convey to the mind of the public that if an electrical installation is effected in any building or factory of any character, even a powder plant or magazine, in a proper manner, it can be handled by a child without the slightest fear of any damage or danger. Therefore, I think it my duty to express my opinion to the public, and notify them that when they wish to use electricity, on account of its cleanliness, comparatively low cost, and small amount of energy required to have it installed in a first-class way on the premises, and it will be impossible to have any trouble or accident with electric motive power, which is the principal element of life.

"Therefore the public should employ a *consulting electrical engineer*. . . . ."

These extracts speak for themselves.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

FRANCE.—A statement of the duties leviable in France on electrical and other similar materials was published in the Electrical Review of February 19th and 26th last. At the same time a statement of proposed new duties was also given. These duties have not yet been put into force, so that the rates at present leviable are those given in the column "Present rates" in the statement referred to.

FRANCE—ALGERIA.—The duties are the same as those levied on goods imported into France.

FRANCE—CORSICA.—The duties payable on goods imported into Corsica from countries other than France, and dutiable by weight, are the same as those levied on goods imported from such countries into France, reduced one-half for the portion exceeding 6 fr. per 100 kg.

FRENCH CONGO.—(1) Gaboon.—In the district not included in the Conventional Basin of the Congo the same duties (with a few exceptions) are levied as in France.

(2) Conventional Basin of the Congo.—A duty of 10 per cent. *ad valorem* is levied on all imported goods with the exception of spirits (dutiable at special rates) and the following, which are free of duty:—Steam engines, machinery for industry or agriculture and tools for industry, locomotives, carriages and railway material of various kinds during the construction of the railway for which they are intended (afterwards 3 per cent. *ad valorem*), scientific instruments.

FRENCH GUIANA.—The duties levied on goods imported from countries other than France into French Guiana are the same as those levied in France (with a few exceptions); but, in addition to these duties, certain consumption and octroi duties are also levied on French and foreign goods alike.

The following consumption duties are payable on the goods named:

	Fr. per 100 kg.
Resins and resinous substances	1
Cement	·24
Cast-iron, rough	·60
Steel in bars, rails	3·20
" " other	3
Steel in sheets	3·20
Copper, pure, in pigs	4·80
" alloyed	5·60
Lead, in pigs	4·60
Tin, in pigs	7
Zinc, in pigs	2·40
Mercury	20
Other metals	4 % ad val.
Acids, salts and other chemicals	4 % ad val.
Earthenware pipes	4 % ad val.
Glassware	4 % ad val.
Paper	4 % ad val.
Machines not intended for agriculture or industry	4 % ad val.
Cutlery and all metal goods	4 % ad val.
Material for telegraph and telephone lines	free
Goods not specially mentioned	4 % ad val.

The following octroi duties are payable on the goods named:—

	Fr. per 100 kg.
Resins and resinous substances	1·25
Lubricating oils	5
Cement	·30
Cast-iron	·75
Iron rails	4
Other iron in bars	3
Steel rails	4
Other steel in bars	4
Steel sheets and plates	4
Copper, pure, in pigs	6
" alloyed, "	7
Lead, in pigs	5·65
Tin "	8·75
Zinc "	3
Metals not named	5 % ad val.
Acids, salts and other chemical products	5 % ad val.
Glassware	5 % ad val.
Metal ware	5 % ad val.
Machinery for industry and agriculture	free
Materials for telegraph and telephone lines	free

FRENCH INDIES.—No duties are levied on electrical and similar goods imported into the French Establishments in India.

FRENCH INDO-CHINA.—The duties on goods imported into French Indo-China from countries other than France are, with some exceptions, the same as those levied in France. The following are some of the exceptions:—

Building stones, cut or not	free
Mineral oils	4 fr. per 100 kg.
Complete machines, mounted or not, for gold-mining (not including the motor)	8 " "

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,811. "Improvements in and relating to alternating current electric induction motors." Siemens Bros. Dynamo Works, Ltd., and E. O. Kieffer. July 19th.

16,812. "Improvements in fans for cooling dynamo-electric machines and for other purposes." Siemens Bros. Dynamo Works, Ltd., and E. O. Kieffer. July 19th.

16,823. "Improvements in conduits and adaptors for electrical conductors and the like, and in the method of protecting the latter." H. Moss. July 19th.

16,855. "Improvements in or connected with the production of electric light between the electrodes of arc lamps." Ges. für Elektrotechnische Industrie m.b.H. and J. Gyuris. July 19th. (Complete.)

16,904. "Improvements in electric arc lamps." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany.) July 20th. Complete.)

16,912. "Improved hygienic guard for the talking funnels of telephone apparatus." E. Sand. July 20th. (Complete.)

16,924. "Improvements in electric arc lamps." F. Proctor. July 20th.

16,928. "Arrangement of connections for automatic sub-station switchboards with several exchange double leads in which the selection of the subscriber is effected from the exchange by means of alternating currents of different frequencies." Siemens & Halske Akt.-Ges. (Date applied for under Sec. 91 of the Act, August 20th, 1908, being date of application in Germany.) July 20th. (Complete.)

16,931. "Improvements in electroplating baths." B. J. B. Mills. (A. Van Winkle.) July 20th. (Complete.)

16,948. "Electric controlling and distributing mechanism for sparking devices." G. D. Rogers. (Date applied for under Sec. 91 of the Act, August 7th, 1908, being date of application in United States.) July 20th. (Complete.)

16,950. "Improvements in or connected with electric wiring and switching systems." B. P. Scattergood and T. G. Bray. July 20th.

16,985. "Improvements in insulating former wound coils or the like." Siemens & Halske Akt.-Ges. (Date applied for under Sec. 91 of the Act, July 21st, 1908, being date of application in Germany.) July 21st. (Complete.)

16,990. "Improvements in and relating to electric mechanism for writing and colour changing signs." R. F. Venner. July 21st.

17,023. "Method of obtaining from or impressing upon electric dynamos or motors electrical pressures of various magnitudes." W. J. Branson. July 21st.

17,031. "Improvements in and relating to protective devices for electrical transmission and distribution systems." British Thomson-Houston Co., Ltd., and E. B. Wedmore. July 21st.

17,043. "Improvements in or relating to small transformers." A. J. Boult. (Deutsche Elektro-Sparklicht G.m.b.H., Germany.) July 21st. (Complete.)

17,101. "Improved insulating device for electric lampholders." H. Hirst and H. J. Coates. July 22nd.

17,104. "Improvements in telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) July 22nd. (Complete.)

17,106. "Improvements in or relating to crossings and junctions for electric traction systems." E. M. Munro and Railless Electric Traction Co., Ltd. July 22nd.

17,107. "Improvements in intercommunication telephone instruments." J. A. Romer. July 22nd.

17,114. "Improvements in or relating to electrically operated switches suitable for use in connection with train lighting and for other purposes." M. W. W. Mackie. July 22nd.

17,137. "Improvements in sound intensifiers for telephone mouthpieces and the like." H. Foss. July 22nd. (Complete.)

17,138. "Improvements in electric meters indicating maximum consumption." Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz. (Date applied for under Sec. 91 of the Act, August 3rd, 1908, being date of application in France.) July 22nd. (Complete.)

17,189. "Improvements in and relating to dynamo-electric generators for generating systems." A. H. Midgley and C. A. Vandervell. July 23rd.

17,190. "Improved electrical switching devices." H. Lavy. July 23rd.

17,199. "Improvements in and relating to the regulation of dynamo-electric machines." Allgemeine Elektricitate Ges. (Date applied for under Sec. 91 of the Act, July 23rd, 1908, being date of application in Germany.) July 23rd. (Complete.)

17,208. "Improvements in electric and other advertising and the like purposes." W. K.-L. Dickson. July 23rd.

17,215. "Improvements in beams, particularly applicable for use as masts of wireless telegraphy stations." S. Eisenstein. July 23rd. (Complete.)

17,217. "Improvements in apparatus for the production of electric impulse charges for the purpose of wireless telegraphy." S. Eisenstein. (Application for Patent of Addition to No. 10,019/1908.) July 23rd. (Complete.)

17,230. "Improvements in electric incandescent lamp fittings and the like." Wardle Engineering Co., Ltd., and W. Wardle, jun. July 24th.

17,254. "Improvements in windings for the armatures of dynamo-electric machines and the like." A. Greenwood and F. T. Chapman. July 24th.

17,274. "Improvements relating to electric switches." H. R. Schultz. July 24th.

Embezzlement by a Tramway Manager. — At Glasgow Sheriff's Court, Arthur Delves, late manager of the Airdrie and Coatbridge Tramways Co., pleaded guilty to a charge of embezzlement. The indictment was to the effect that between January 4th, 1908, and June 19th, 1909, he embezzled £204 14s. 10d. The accused had been manager of the tramways for several years at a salary of £250 per annum; he had had serious illness in his family, and became pressed for money. His wife was in very bad health, and there were four children. The Sheriff-substitute described the case as a very painful one, and passed sentence of three months' imprisonment.

Electricity in Servia. — The *Bulletin Commercial* (Brussels) of July 17th contains a long article on the electrical industry in Servia. The report draws attention to the good openings in that country for electric lighting and kindred appliances, and to the necessity not only for supplying articles of good quality at reasonable cost, but also for developing the market on the spot by means of personal visits. The establishment in Servia of a depôt where electrical material could be seen by persons interested would, according to this report, be the most efficient way of rapidly increasing business.—*Board of Trade Journal.*

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Process of and Means for Preventing Oxidisable Metals and the like from Rusting after they are Electroplated. C. Mason. 13,715. June 29th.

Electrodes and Resistances for Electric Furnaces, Radiators, Lamps and the like. C. Cornaro. 13,784. June 29th. (Date applied for under International Convention, June 27th, 1907.)

Regulating Device for Electric Circuits. F. Ritchie. 13,957. July 1st.

Astronomical Compass and Time Indicator. H. Reeves. 14,008. July 2nd. (Cognate application No. 14,523/08.)

Combined Telephone and Telautograph Exchange System. F. Ritchie. 14,401. July 7th.

Automatic Electromagnetic Switch or Cut-out for Disconnecting Charged Conductors in Overhead Systems of Electric Traction or the like. W. Barraclough. 14,468. July 8th.

Electrolytes for Electrolytic Cells. British Thomson-Houston Co., Ltd. (Gen. Elec. Co., U.S.A.) 15,792. July 24th.

Electroplating and like Processes. H. Hutton and R. S. Hutton. 18,246. August 31st.

Electrical Ignition Systems of Internal-Combustion Engines. J. P. Bell. 19,883. September 22nd. (Cognate application No. 20,226/08.)

Stranded Electric Cables. C. J. Beaver and E. A. Claremont. 20,447. September 29th.

Protective Devices for Electric Distribution Systems of the Type known as Lightning Arresters. British Thomson-Houston Co. (Gen. Elec. Co., U.S.A.) 22,135. October 19th.

Electric Cooking and Heating Apparatus. E. Colseur. 22,551. October 23rd.

Manufacture of Filaments for Incandescent Electric Lamps. British Thomson-Houston Co., Ltd., and H. H. Needham. 23,726. November 5th.

Incandescent Electric Lamps. Soc. Francaise d'Incandescence par le Gas (Système Auer). 24,211. November 11th. (Date applied for under International Convention, November 12th, 1907. Application for Patent of Addition to No. 12,723/08.)

Mechanical Connectors for Electric Cables. J. Stratton and E. A. Claremont. 23,796. December 10th.

Wireless Telegraphy and the like. S. Eisentein. 22,738. December 23th.

1909.

Magnetic Separating Machines. Rapid Magnetting Machine Co., H. H. Thompson and A. E. Davies. 835. January 6th. (Date applied for under Rule 13, July 14th, 1908.)

Aluminium Electrolytic Cells. British Thomson-Houston Co. (General Electric Co., U.S.A.) 1,345. January 19th. (Date applied for under Rule 13, September 4th, 1908.)

Armature Windings for Dynamo-Electric Machines. N. W. Storer. 3,831. February 16th. (Date applied for under International Convention, March 2nd, 1908.)

Magnetic Locking Device for Locking Railway Carriage Doors, Safes, or for other Purposes. G. P. Fairless and W. T. Dixon. 4,863. February 27th.

Electric Motor-Generator Sets. British Thomson-Houston Co. (General Electric Co., U.S.A.) 5,119. March 2nd.

Means for Use in Connection with the Electric Ignition Gear of Motor Road Vehicles to Prevent Starting of the Vehicle by Unauthorised Persons. J. G. Hay. 6,105. March 13th.

Device for Converting a Series of Electrical Contacts of Short Duration into a Contact of Longer Duration. R. Plato. 6,646. March 20th.

Alternating-Current Arc Lamps. M. Korting. 4,122. February 9th.

Electric Arc Lamps. H. P. Bleckly and R. Brown. 9,516. April 21st.

Oil Transformer Explosion.—Referring to the partial destruction by fire of the station of the Trinidad (Col.) Electric Light and Power Co., the *Electrical World* learns that the total loss was somewhat under $100,000, and that the fire was primarily due to the arcing over of a rotary converter, which short-circuited coils in three oil transformers installed on a wood floor in the same building. Probably owing to low oil, an explosion took place in the case of one of the transformers, which blew the top off, rent holes in the side and scattered burning oil over the wood floor. Within a few minutes the engine room was untenable, and by the greatest effort only were the fires drawn under boilers and danger of explosion averted before the boiler house roof fell in. The fire department was helpless when it did arrive, as oil had been by that time blown about from all the transformers in the station. The switchboard was dropped through to the basement. The new high-tension portion of the station was not cut off by a fire wall, and was completely destroyed. The only pieces of apparatus in the entire station not seriously injured were the boilers, two steam turbine units and the storage battery, which latter was only partially cut off, and suffered considerable damage from broken plates and jars. No insurance policies were in force, as upon the reorganisation of the company a few years ago the risk was re-rated with increases owing to wood floor in bad condition, oil transformers on wood floor, and large masses of combustible insulation beneath the wood floor from generators to switchboard. As a consequence the company concluded that it could better afford to carry its own insurance, though the result has hardly borne out this belief.